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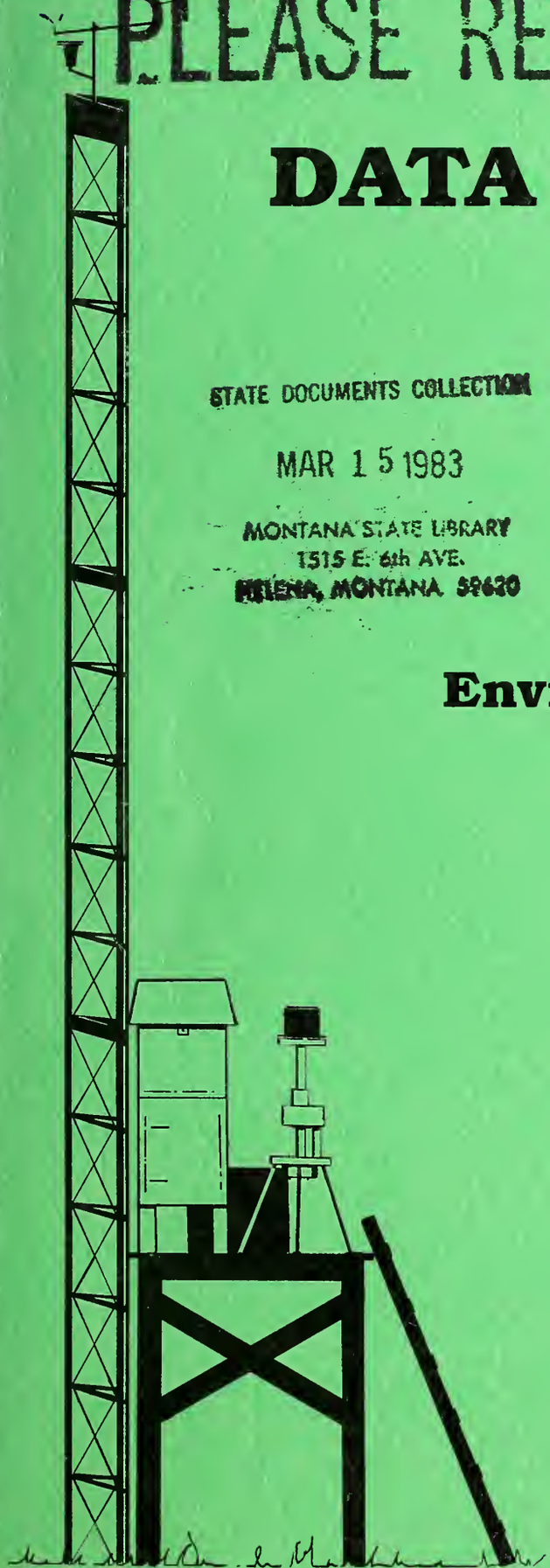

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MONTANA AIR QUALITY DATA AND INFORMATION SUMMARY FOR 1981

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September, 1982

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I.
INTRODUCTION

I. INTRODUCTION

The Montana Air Quality Data and Information Summary for 1981 serves two primary purposes. The first is to summarize air monitoring data from various areas of the state; the second is to provide information on several air quality topics.

The data summary portion is intended as an overview of monitoring activities throughout the state for 1981. For purposes of discussion, we have divided the state into ten study areas. Within each area we have provided the reader with various background information. This includes population growth or decline, climate and geography as it relates to air quality, and lists of possible air pollution sources. Following this information, we have tabulated the ambient data and made comments with regard to its significance.

The second portion of this report includes several appendices on a variety of topics relating to air quality. This includes discussions on Prevention of Significant Deterioration, Attainment-Non Attainment, Ambient Air Quality Standards, Smoke Management and Visible Emission Documentation. Other miscellaneous tables, lists and short reports are included for the reader's benefit and informational needs.

Although this report is entitled the 1981 Data Summary, 1980 data has also been included. Reporting two years of data has the added benefit of allowing the reader to compare one year to another.

The subject of air quality is often complicated and data intensive. It cannot be covered completely in any one report. We hope that this report will serve the needs of most data and information users.

II.
STUDY AREAS

II. STUDY AREAS

The data summary portion of this report is divided into ten study areas. Within each area, we have provided various background information. This includes population growth or decline; climate and geography; and listings of air pollution sources. For each study area, monitoring site descriptions are given and site locations are shown on an area map.

The ambient data is listed in various ways. Total suspended particulate (TSP) concentrations are tabulated showing annual geometric averages, highest and second-highest daily concentrations. Tables of respirable particulates in most cases show annual averages and highest concentrations for each size classification. Continuous data are tabulated giving monthly averages and highest hourly concentrations except for carbon monoxide, where the highest eight-hour average is also provided. Metals, sulfates and nitrates are tabulated in the same manner as TSP. Tables of sulfation rate and fluoride give annual averages and the highest monthly average.

Table I lists all monitoring stations which were active in 1981. Some stations didn't provide enough data for analysis but nevertheless are included to present the total monitoring network. Table II lists meteorological sites, locations, dates of operation and types of meteorological equipment operated at each site.

The data included in this report are a combined effort of the Air Quality Bureau (Montana Department of Health and Environmental Sciences), the Cascade County Air Pollution Control Agency, the Missoula City-County Health Department, and the Yellowstone County Air Pollution Control Agency.

TABLE I

MONTANA AIR MONITORING STATIONS 1981

Area	Site	TSP	RP	Nitrate	Sulfate	Metals	S Rate	SO_2	NO_2	THC	O_3	CO	F	Dustfall	Met
Anaconda															
	Lincoln School	x				x		x							x
Big Horn County															
	**Thomas Ranch/Decker	x													
	***Decker #2 AQB Lab	x													
Billings															
	Lockwood School	x					x								
	KGHL	x					x								
	City Hall	x					x								
	Grand Ave. School	x					x								
	Garden Ave.						x								
	County Offices						x								
	Bench School						x								
	Bitterroot						x								
	Johnson Lane						x								
	Mountain View Blvd.						x								
	1200 Minn. Ave.						x								
	5th & 28th						x								
	27th & 10th Ave. So.						x								
	East Conoco						x								
	Two Moon Park						x								
	Newman School						x								
	Klenck School						x								
	Johnson & Lockwood						x								
	Johnson Rd. N.						x								
	Woodland						x								
	*Coburn Road						x	x							x
	Fairgrounds (Metra)							x				x			x
	Taft School	x	x					x							x
	*Piccolo & Frontage Rd.						x								
	*Shawnee Park							x							x
	*No. Johnson Lane							x							x
	*Lockwood Park							x							x

TABLE I

MONTANA AIR MONITORING STATIONS 1981

Area Site	TSP	RP	Nitrate	Sulfate	Metals	S Rate	SO_2	NO_2	THC	O_3	CO	F	Dustfall	Met
Bozeman														
Traphagen Hall	x													
East Main	x													
**MSU Family Housing	x													
*Whittier School	x													
Butte														
Greeley School	x													
Hebgen Park #2	x							x		x				
Walkerville (Blaine Sch)	x													
Dr. Canty	x													
Cascade County														
West Hill													x	
Airport Industrial													x	
Sun River													x	
*KOA Campground													x	
*ABBCO													x	
*4th St. & 4th Ave.													x	
Columbia Falls														
Anders Residence	x	x												
Daniels County														
Scobey Border #1	x	x	x	x			x							x
Richardson	x		x	x										
Hanrahan	x		x	x			x							x
Dawson County														
**Lindsay/Wielgosh	x													
Deer Lodge County														
**Highway Junction	x				x									
**Warm Springs	x													
East Helena														
Hastie	x				x	x								
*Hadfield	x				x									
A&W	x				x		x							
*Fire Station	x				x									

TABLE I

MONTANA AIR MONITORING STATIONS 1981

Area	Site	TSP	RP	Nitrate	Sulfate	Metals	S Rate	SO_2	NO_2	THC	O_3	CO	F	Dustfall	Met
Flathead County															
	Dehlboms Mt. Box												x		
	Feirstein												x		
	RE Owen												x		
	Badrock Substation												x		
	*Dehlboms Field												x		
	Anaconda South												x		
	Teakettle Mtn #1												x		
	Teakettle Mtn #8												x		
	Aluminum City												x		
	NAAC	x											x		
	Polebridge	x	x	x	x	x									
	Bigfork	x		x	x										x
	*Whitefish	x		x	x										
	Glacier Int. Airport	x	x	x	x										x
	Big Prairie Met														x
	Glacier Park (15 sites)												x		
Gallatin County															
	Big Sky Golf Course														x
Glendive															
	Dawson Co. Comm. Coll.	x													
Great Falls															
	Hospital(CCHD)	x												x	
	Fire Station #1	x												x	
	Kiwanis Park	x													
	Mountain States													x	
	Riverview School	x													
	Black Eagle	x													
	Lincoln School	x													
	GF Federal										x				
	Downtown	x													

TABLE I

MONTANA AIR MONITORING STATIONS 1981

Area	Site	TSP	RP	Nitrate	Sulfate	Metals	S Rate	SO_2	NO_2	THC	O_3	CO	F	Dustfall	Met
Havre															
	Central City Bldg.	x													
Helena															
	Cogswell Bldg.	x													
	**Valley Bank	x				x									
	Capital Courts	x													
	*Sunhaven	x													
	*Super Save Groc.	x													
Jefferson County															
	Microwave	x				x	x								
	Broudy Ranch						x								
	*Montana City School	x				x									
Kalispell															
	Universal Athletic	x	x	x	x										
	Evergreen Rural Elec.	x													
Lake County															
	Polson	x	x	x	x										x
	Ronan Ninepipes	x	x	x	x										x
	Swan River	x		x	x										
Laurel															
	Junior High	x					x								
	1 Mi. NE Coop						x								
	3/4 Mi W. Coop						x								
	1/2 Mi S Coop						x								
	St. John Church						x								
	E. of Laurel						x								
	Farm E. of Cenex						x								
	West Coop						x								
	New Farm	x						x							x
	*Laurel BN							x							x

TABLE I

MONTANA AIR MONITORING STATIONS 1981

Area	Site	TSP	RP	Nitrate	Sulfate	Metals	S Rate	SO_2	NO_2	THC	O_3	CO	F	Dustfall	Met
Lewis & Clark County															
	East Stack Station						x								
	Schneider Residence						x								
	*Dartman	x				x									
	*South	x				x									
	*Vollmer	x				x									
	*Padbury	x				x									
	*Canal	x				x									
Lewistown															
	Downtown	x													
Libby															
	Brown Residence	x													
Miles City															
	PCA Bldg.	x													
Missoula County															
	Malfunction Junc. S.E.										x				
	Courthouse Roof	x	x		x										
	Hoerner-Waldorf #1	x			x										x
	Hoerner-Waldorf #2	x			x										
	Rose Park	x			x						x				x
	**McLeod park	x													
	**Schilling Street	x													
	*Boyd Park	x									x				
	**Downtown										x				
Powell County															
	Grant Kohrs (5 sites)						x						x		
	Smith Ranch (Ovando)	x													

TABLE I

MONTANA AIR MONITORING STATIONS 1981

Area	Site	TSP	RP	Nitrate	Sulfate	Metals	S Rate	SO_2	NO_2	THC	O_3	CO	F	Dustfall	Met
Silver Bow County															
	**Tierney Res.	x													
	**Ramsay W.												x		
	**Ramsay N.												x		
	**Stauffer ESE												x		
	**South Stauffer												x		
	**South of Pond												x		
	**Ramsay Power Station												x		

*New site in 1981
**Discontinued in 1981
***Sampler operated by private industry with filter analysis performed by AQB

KEY

TSP - Total Suspended Particulate
RP - Respirable particulate
S Rate - Sulfation Rate
SO_2 - Sulfur Dioxide
NO_2 - Nitrogen Dioxide
O_3 - Ozone
CO - Carbon Monoxide
F - Fluoride
Dustfall - Total Dustfall
Met - Various meteorological parameters

TABLE II

LOCATIONS OF METEOROLOGICAL EQUIPMENT

Site	Site ID	Code	County	City	Wd	AR	Neph	PyhM	PyrM	BP	Temp	DP	Long/Lat UTM*	Date of Op.
Central Park	0080 059	F01	Yellowstone	Billings	X				X	X	X	X	1083219-454651	8/78-5/80
Billings Vo-Tech	0080 302	F02	Yellowstone	Billings		X								6/78-12/81
Farm E. of CENEX	0840 009	F01	Yellowstone	Laurel	X								1084435-453939	1/77-7/80
Laurel (New Farm)	0840 014	F02	Yellowstone	Laurel	X								1084425-454007	10/81-12/81
Taft School	0080 062	F01	Yellowstone	Billings	X				X	X	X	X	1082938-454637	8/80-12/81
Lockwood School	0080 006	F05	Yellowstone	Billings	X								1082630-454757	8/79-5/80
Fairgrounds	0080 061	F02	Yellowstone	Billings	X								1082845-454755	9/80-12/81
Shawnee Park	0080 063	F02	Yellowstone	Billings	X									1/81-12/81
Coburn Road	0080 066	F05	Yellowstone	Billings	X								*5073.3-697.4	9/81-12/81
Lockwood Park	0080 065	F05	Yellowstone	Billings	X								*5075.5-700.0	9/81-12/81
North Johnson Lane	0080 064	F05	Yellowstone	Billings	X								*5079.1-701.1	9/81-12/81
Laurel BN	0840 015	F05	Yellowstone	Laurel	X								*5059.5-675.1	9/81-12/81
Kiwanis Park	0660 016	F01	Cascade	Great Falls	X								1111632-473035	1/80-2/80
Lincoln School	0020 007	F07	Deer Lodge	Anaconda	X				X	X	X	X	1125634-460731	7/78-6/81
Hiway Jct.	0040 004	F02	Deer Lodge	Anaconda	X	X							1125317-460809	10/77-8/79
County Airport	0400 704	J02	Deer Lodge	Anaconda	X								*5111.5-356.5	2/79-5/79
No. 2 Discharge Pond	0400 708	J02	Deer Lodge	Anaconda	X								*5113.5-362.0	1/79-5/79
Weather Hill	0400 707	J02	Deer Lodge	Anaconda	X								*5110.7-354.1	1/79-5/79
Mill Creek	0400 706	J02	Deer Lodge	Anaconda	X								*5107.0-354.5	1/79-2/79
Alpine West	0160 015	F02	Silver Bow	Butte	X								1123032-450045	8/79-6/78
Hebgen Park	0160 017	F01	Silver Bow	Butte	X		X						1123129-460013	6/78-12/80
Microwave	0760 903	F02	Jefferson	E. Helena	X								1115501-463244	1/78-3/79
A&W	0860 008	F02	Lewis&Clark	E. Helena	X								1115425-454637	2/80-6/80
Big Sky Golf Course	0520 004	F05	Gallatin	Bozeman	X								*5012.5-477.5	6/81-12/81
Randall Ranch	1240 009	F03	Powder River	Broadus	X									9/77-8/78
Fort Peck	0980 001	F03	McCone	Ft. Peck	X								1062959-475943	9/77-5/79
Fisher Butte	1360 003	F03	Rosebud	Lame Deer	X								1063914-453734	
BN Site	1360 027	F02	Rosebud	Colstrip	X								1063443-455130	8/78-12/78
Scobey #1 (Border)	0340 001	F03	Daniels	Scobey	X	X	X	X	X	X	X	X	1052400-485930	3/77-12/81
Scobey #2 (Richardson)	0340 002	F03	Daniels	Scobey	X								1052513-484835	8/78-5/79
Scobey #4 (Hanrahan)	0340 004	F05	Daniels	Scobey	X						X		1141500-481838	11/80-12/81
Glendive Microwave	0360 001	F03	Dawson	Glendive	X								1140830-420200	9/77

TABLE II

LOCATIONS OF METEOROLOGICAL EQUIPMENT

Site	Site ID	Code	County	City	Wd	AR	Neph	PyhM	PyrM	BP	Temp	DP	Long/Lat UTM*	Date of Op.
Big Fork	0480 036	F05	Flathead	Big Fork	X						X		1140557-480400	11/79-12/81
Kalispell Airport	0480 304	F05	Flathead	Kalispell	X	X	X	X	X	X	X	X	1141500-481838	1/78-12/81
Water Supply	0480 302	F05	Flathead	Col. Falls	X				X		X		1140830-482000	10/76-6/78
Polebridge	0480 305	F05	Flathead	Polebridge	X						X		1141703-484709	9/78-11/78
Big Prairie	0480 308	F05	Flathead	Polebridge	X						X		1141841-484829	11/78-12/81
Ronan-Ninepipe	0820 012	F05	Lake	Ronan	X	X	X						1140759-472735	1/79-12/81
Polson	0820 304	F05	Lake	Polson	X						X		1140727-474120	10/78-12/81
Ronan	0820 011	F05	Lake	Ronan	X								1140546-473054	1/80-3/80
TV Mountain	1100 701	J05	Missoula	Missoula							X		1135200-470000	5/78-4/80
Lions Park	1100 019	F01	Missoula	Missoula	X		X		X	X	X	X	1140025-465105	12/77-8/80
Stiegler	1100 703	F05	Missoula	Missoula	X								1140814-465415	5/78-3/80
Olofson	1100 702	F05	Missoula	Missoula	X								1140424-464949	7/78-3/80
U of M	1100 704	F05	Missoula	Missoula	X								1135840-465150	5/78-3/80
Rose Park	1100 020	G01	Missoula	Missoula	X		X		X	X	X	X	1140014-465126	9/80-12/81
Hoerner-Waldorf #1	1100 015	G02	Missoula	Missoula	X								1141029-465700	12/77-12/81
Malfunction Jct. SE	1080 005	F01	Missoula	Missoula	X								*5192.5-727.5	4/80-5/80

*New site in 1981
**Discontinued in 1981

Wd - wind speed, wind direction and wind direction standard deviation
AR - Acoustic radar
Neph. - nephelometer
PyhM - Pyrheliometer
PyrM - Pyranometer
BP - Barometric pressure
Temp - temperature
DP - dew point

A. ANACONDA

A. ANACONDA

The Anaconda study area includes monitoring sites in Deer Lodge and Powell counties (Table A-I and Figure 1-A). In the past, the majority of the air monitoring conducted in this area centered around the city of Anaconda. However, in mid-1981 the Air Quality Bureau shut down most of its air monitoring sites in the area due to the closure of the Anaconda copper smelter.

Deer Lodge county and the southern half of Powell county contain the Deer Lodge valley and surrounding mountains. The valley slopes from an elevation of 5,200 feet at Anaconda in the south to approximately 4,400 feet at Garrison at the north end. With the Anaconda-Pintlar Wilderness to the south and west, the Flint Creek range to the west, and the Continental Divide to the east, the area is subject to temperature inversions about 40 percent of the year.

The north half of Powell county is separated from the Deer Lodge Valley by a range of mountains and generally lies in the upper Blackfoot Valley. The entire area is used almost exclusively for hay production and livestock grazing.

Historically, the main focus of attention for monitoring air pollutants in Anaconda has been emissions from the Anaconda copper smelter. In past years the smelter emitted up to 200,000 tons per year of sulfur dioxide (SO_2). In addition to the SO_2 the smelter emitted particulate matter containing heavy metals: lead, arsenic, and cadmium. In July 1980 a labor strike closed the smelter and on September 30, 1980, the Anaconda Company announced the permanent closure of the 80-year-old smelter due to economic reasons. As a consequence, SO_2 has been virtually eliminated from the valley.

Table A-I

Anaconda Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Anaconda Lincoln School	Deer Lodge	State AQB	Population oriented	Suburban-residential	Cedar Street, Anaconda
*Highway Junction	Deer Lodge	State AQB	Source oriented	Rural-agricultural	300' E of Lost Creek Hwy & 500' N of County Property
*Warm Springs	Deer Lodge	State AQB	Source oriented	Rural-industrial	Warm Springs
Smith-Ranch (Ovando)	Powell	State AQB	Background	Rural-agricultural	Five miles E. of Ovando

*Site discontinued in 1981

Figure 1-A

ANACONDA
Air Monitoring Stations

#	Site Name
1	Lincoln School
2	Highway Junction
3	Warm Springs

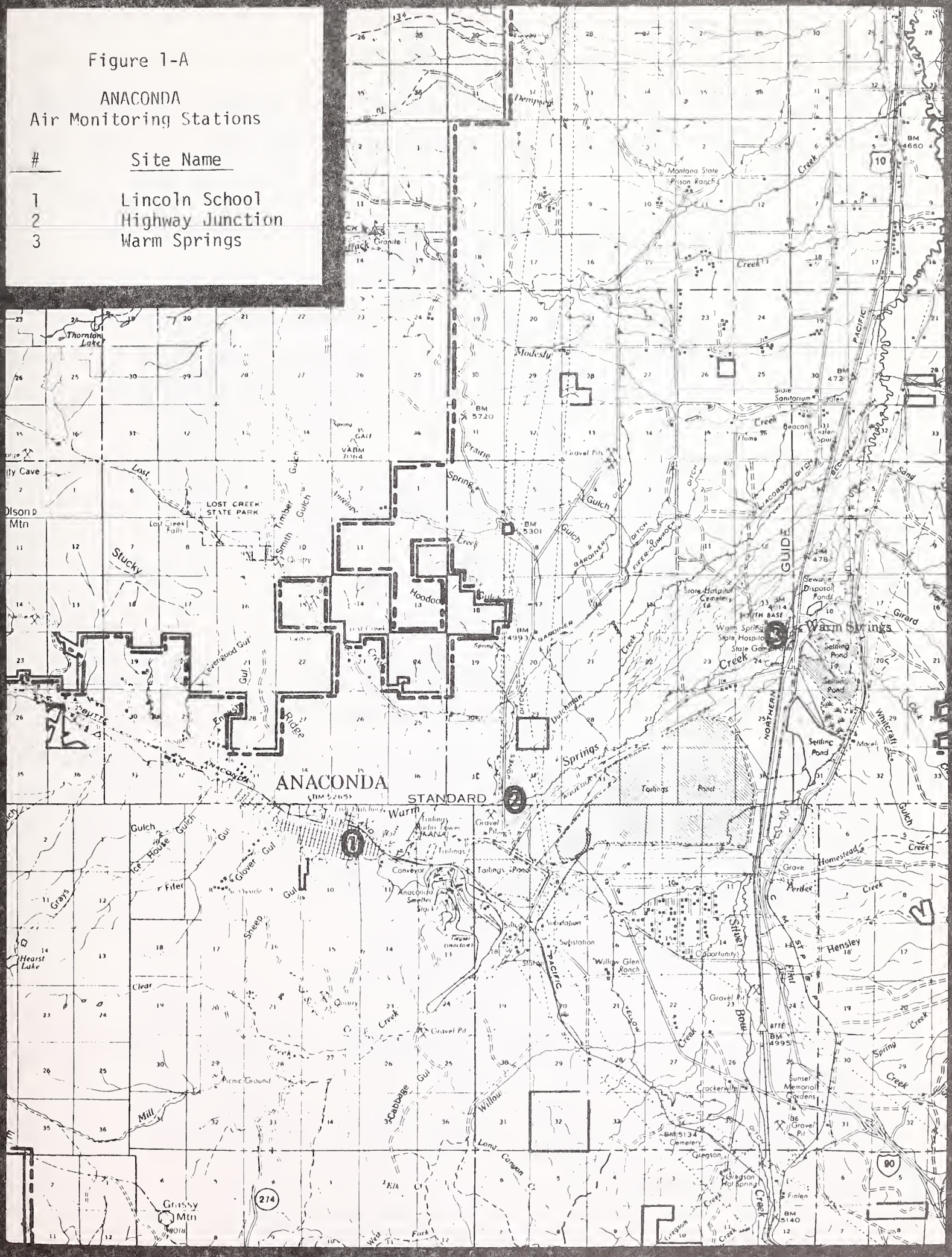


Table A-II summarizes sulfur dioxide concentrations for the Lincoln School site in 1980 and 1981. The 1980 data was included for comparison purposes. The Lincoln School site was the only SO_2 monitoring station operated in the Anaconda area during 1981. In May of 1981 SO_2 monitoring was terminated at Lincoln School.

Table A-II
Anaconda Area-Sulfur Dioxide
Parts Per Million

	Lincoln School - 1980		Lincoln School - 1981	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	1.00	.03	.02	.00
Feb	.65	.04	.01	.00
Mar	.61	.02	.01	.00
Apr	1.72	.05	.01	.00
May	1.15	.08	.01	.00
Jun	1.51	.05	Monitoring Site	
Jul	.00	.00	shut down	
Aug	.10	.01		
Sep	.02	.01		
Oct	.02	.01		
Nov	.03	.02		
Dec	.02	.00		
Annual Mean:		.02		.00

Table A-III summarizes TSP values from sites in the Anaconda area as well as the Smith Ranch (Ovando) site in Powell County. Although some high TSP readings were recorded, none violated the Federal 24-hour standard (260 ug/m^3) and the annual means were all well below the 75 ug/m^3 standard.

Table A-III
Anaconda Area - TSP
Micrograms Per Cubic Meter

	1980			1981		
Site	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
Lincoln School	54	165	154	45	149	142
Highway Jct.	32	93	83	*19	59	57
Smith Ranch (Ovando)	21	130	93	16	98	71
Warm Springs	32	158	90	26	161	135

*Less than eight months data

With the conclusion of the Montana Air Pollution Study in 1979, monitoring for respirable particulate, ozone, nitrogen dioxide, and hydrocarbons was terminated in the Anaconda area.

Trace heavy metals such as lead, cadmium and arsenic are analyzed by atomic absorption from high volume sampler filters. The Air Quality Bureau continued to monitor lead at the Lincoln School site during 1981. Table A-IV gives a summary of lead analyses done on hi-vol filters from the Lincoln School site. Lead is of particular interest because of its high toxicity.

Table A-IV
Anaconda Area - Lead
Micrograms Per Cubic Meter

	1980			1981		
Site	Mean	1-High	2-High	Mean	1-High	2-High
Lincoln School	.17(12)	.77	.52	.07(12)	.37	.19
Highway Junction	.11(12)	.36	.35	.03(5)	.12	.11

( ) - parentheses denotes number of sample months

Wind in the Anaconda area tends to be southwesterly much of the year. During the spring the wind is predominately from the northwest. These winds provide ventilation which keeps the inversion frequency lower than other areas of Western Montana. This statement is probably not true for the upper Blackfoot Valley.

B. BILLINGS

B. BILLINGS

The Billings study area includes air monitoring sites in Yellowstone County. The area is located between the Northern Great Plains and the Rocky Mountains; consequently, it has climatic conditions common to both regions. The elevation for this area ranges from 3100 to 3400 feet above sea level. Billings and Laurel both receive about 14 inches of precipitation per year. Population growth has been substantial in the last ten years. This is primarily due to coal and oil development. Yellowstone County's population increased 23 percent from 87,367 in 1970 to 107,661 in 1980; Billings' increased 11 percent from 61,581 to 68,343 and Laurel's 23 percent, from 4,454 to 5,469.

Pollution sources include the following:

1) Three oil refineries (SO_2, particulate, hydrocarbons, NOx, SO_3)
2) Coal-fired power plant (SO_2, particulate, NOx)
3) Sugar beet refinery (SO_2, particulate, NOx)
4) Sulfur plant (SO_2, SO_3)
5) Wood-fired home heating devices (fine particulate, CO)
6) Automobiles (CO, NOx, re-entrained particulate)

Billings area monitoring sites are listed on Table B-I and shown in Figure 1-B.

Table B-II summarizes TSP values for Billings and Laurel area hi-vols. None of these sites violated the Federal Primary annual TSP standard (75 ug/m^3), but the Taft School site recorded one reading in excess of the 260 ug/m^3 24-hour standard.

Table B-I

Billings Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Billings					
Lockwood School	Yellowstone	State AQB	Special studies	Suburban-industrial	Hardin Road E of Billings Lockwood School Complex
Lockwood Park	Yellowstone	State AQB Contractor	Special studies	Suburban-industrial	Lockwood area Little League Park
Coburn Road	Yellowstone	State AQB Contractor	Source oriented	Rural-rangeland	On ridgetop 1/2 mile S of Lockwood exit of I-90.
No. Johnson Lane	Yellowstone	State AQB Contractor	Source oriented	Rural-agricultural	1 mile W of the I-90 Hardin Interchange
Shawnee Park	Yellowstone	State AQB	Source oriented	Rural-residential	At the I-90 Hardin interchange
KGHL	Yellowstone	*YCAPC	Population oriented	Rural-agricultural	KGHL Station 3 3/4 miles W of Billings on Highway 10
City Hall	Yellowstone	*YCAPC	Population oriented	Center city - commercial	3rd Avenue N & 27th Street Downtown Billings
Grand Ave. School	Yellowstone	*YCAPC	Population oriented	Suburban-commercial	Grand Avenue School adjacent to Billings Business District
Fairgrounds(Metra)	Yellowstone	State AQB	Source oriented	Suburban - industrial	Fairgrounds Complex, 6th Ave. N and Exposition Drive
Taft School	Yellowstone	State AQB	Source oriented	Suburban-industrial	Near Taft School in SE Billings
Laurel					
Jr. High School	Yellowstone	*YCAPC	Source oriented	Center city - residential	Laurel Jr. High School on Colorado Avenue
New Farm	Yellowstone	State AQB	Source oriented	Rural-industrial	2.5 mile NE of Refinery
Laurel BN	Yellowstone	State AQB Contractor	Source oriented	Suburban-industrial	BN switchyards east edge of Laurel

*YCAPC-Yellowstone County Air Pollution Control

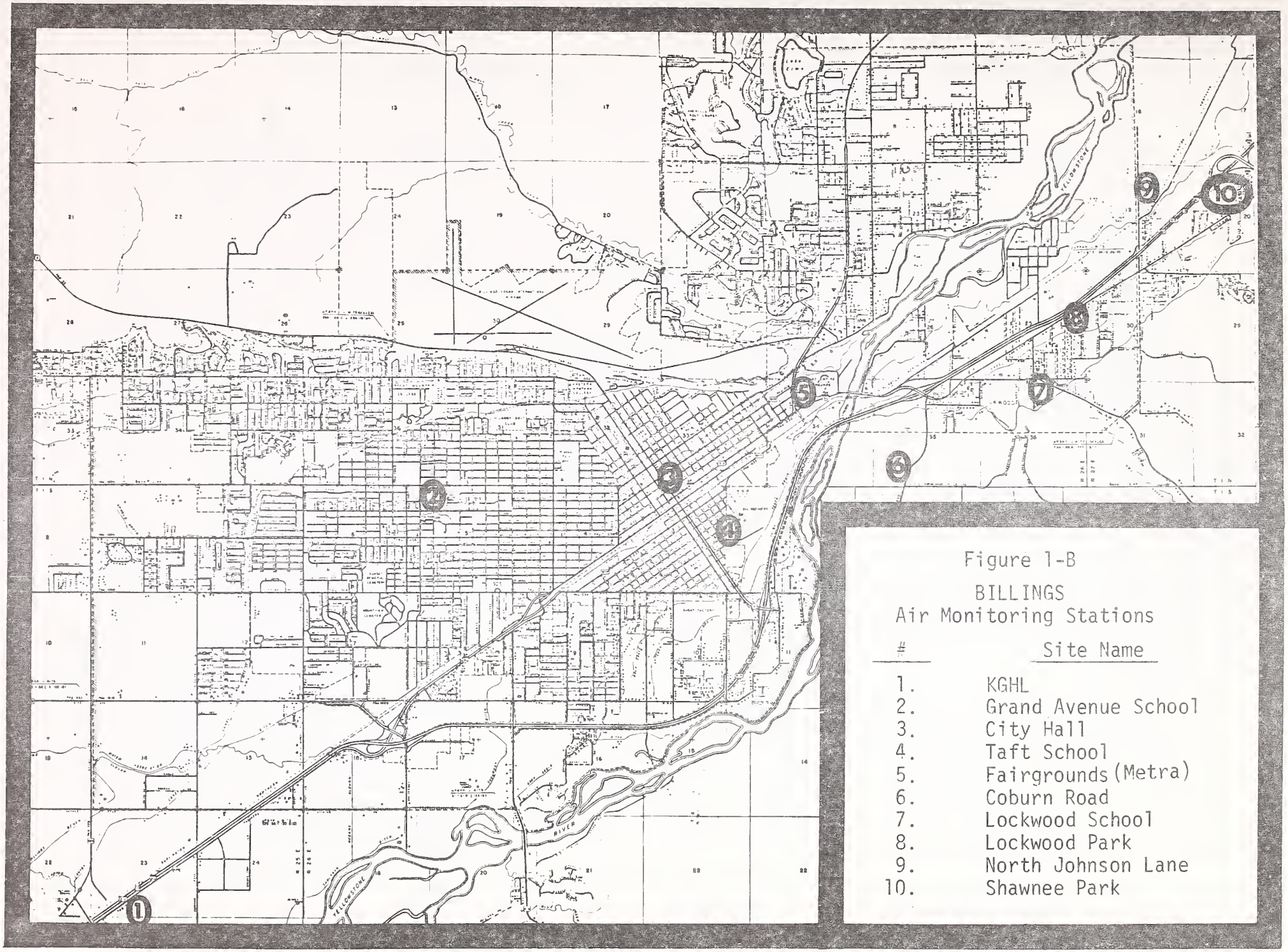


Figure 1-B

BILLINGS
Air Monitoring Stations

#	Site Name
1.	KGHL
2.	Grand Avenue School
3.	City Hall
4.	Taft School
5.	Fairgrounds (Metra)
6.	Coburn Road
7.	Lockwood School
8.	Lockwood Park
9.	North Johnson Lane
10.	Shawnee Park

Table B-II

Billings Area - TSP
Micrograms Per Cubic Meter

Site	1980			1981		
	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
KGHL	48	133	128	47	171	160
Grand Avenue School	72	214	173	72	165	157
City Hall	74	166	150	69	182	155
Taft School	*72	146	134	64	271	234
Lockwood School	*39	172	135	*47	148	102
Laurel Jr. High	48	195	179	39	126	83
Laurel New Farm				43	142	134

*Less than eight months data

Table B-III lists the mean annual and maximum 24-hour respirable particulate values for the Billings area. This sampling was done with a dichotomous sampler, which splits respirable particulate into coarse (2.5-15 micron) and fine (<2.5 micron) fractions.

Table B-III
Billings Area - Respirable Particulates
Micrograms Per Cubic Meter
Size Classification - Microns

Site	Year	<2.5		2.5-15		<15	
		Max	Mean	Max	Mean	Max	Mean
Taft School	80	38.2	16.5(4)	103.6	48.4(4)	141.9	64.9(4)
	81	50.8	14.0(12)	123.4	34.3(12)	154.7	48.3(12)

( ) - parentheses denotes number of sample months

Sulfur dioxide was analyzed at seven locations in the Billings-Laurel area in 1981. Table B-IV summarizes the maximum hourly reading for each month as well as the monthly and annual means. Four sites: Coburn Road, Lockwood Park, North Johnson Lane and Laurel BN, were operated by a private contractor as part of the Billings SO_2 Study.

Table B-IV
Billings Area - Sulfur Dioxide
Parts Per Million

	Taft School - 1980		Taft School - 1981	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.162	.016
Feb			.076	.009
Mar			.213	.011
Apr			.217	.010
May			.147	.008
Jun			.088	.007
Jul			.189	.014
Aug	.420	.030	.102	.011
Sep	.436	.014	.178	.015
Oct	.448	.015	.230	.012
Nov	.179	.009	.186	.012
Dec	.300	.018	.270	.015
Annual Mean:		.015		.011

	Coburn Road - 1981	
	Hourly Max	Monthly Mean
Jan		
Feb		
Mar		
Apr		
May		
Jun		
Jul		
Aug		
Sep	.062	.007
Oct	.410	.032
Nov	.365	.050
Dec	.350	.043
Annual Mean:		.029

Table B-IV (continued)
Billings Area - Sulfur Dioxide
Parts Per Million

	Lockwood Park - 1981		No. Johnson Lane - 1981	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan				
Feb				
Mar				
Apr				
May				
Jun				
Jul				
Aug				
Sep	.126	.009	.044	.007
Oct	.313	.028	.377	.031
Nov	.334	.031	.417	.036
Dec	.186	.022	.227	.031
Annual Mean:		.027		.032

	Laurel New Farm - 1980		Laurel New Farm - 1981	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.122	.014
Feb			.085	.011
Mar			.108	.009
Apr			.127	.007
May			.061	.007
Jun			.050	.005
Jul				
Aug				
Sep			.064	.005
Oct			.100	.005
Nov	.081	.008	.093	.008
Dec	.090	.014	.133	.010
Annual Mean:		.012		.008

Table B-IV (continued)
Billings Area - Sulfur Dioxide
Parts Per Million

	Laurel BN - 1981		Shawnee Park - 1981	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan			.500	.026
Feb			.258	.020
Mar			.278	.018
Apr			.116	.008
May			.149	.009
Jun			.284	.006
Jul				
Aug			.284	.011
Sep	.050	.006		
Oct	.167	.014	.234	.025
Nov	.193	.015	.304	.031
Dec	.153	.014	.255	.027
Annual Mean:		.014		.019

Carbon monoxide was measured at the Fairgrounds (Metra) site during 1981. Table B-V summarizes one-hour and eight hour maximums, monthly means, and annual averages for CO. There were no readings greater than the Montana eight-hour standard of 9 ppm.

Table B-V
Billings Area - Carbon Monoxide
Parts Per Million

	Billings Metra - Fairgrounds - 1981		
	1-Hour Max	Max 8-hour Mean	Monthly Mean
Jan	10.0	5.3	1.2
Feb	9.4	4.2	0.8
Mar	8.1	5.3	0.6
Apr	5.9	2.5	0.7
May	5.9	2.9	1.2
Jun	4.5	2.9	0.8
Jul	5.1	4.5	0.7
Aug			
Sep	6.9	3.7	0.7
Oct	9.0	7.1	1.8
Nov	9.0	5.7	2.2
Dec	22.5	8.5	2.3
Annual Mean:			1.2

Sulfation rate (Table B-VI) was analyzed at numerous sites in Yellowstone County. The sulfation rate is a rough indicator of the quantity of sulfur oxides in the air. The advantage of utilizing the sulfation rate method is that numerous samples can be analyzed economically. The readings are a useful tool in determining sulfur dioxide trends in certain areas.

Table B-VI
Billings Area - Sulfation Rate
Milligrams Sulfur Trioxide Per 100 Square Centimeters Per Day*

	1980		1981	
Site	Max	Annual Mean	Max	Annual Mean
Bitterroot	.53	.35	.62	.37
Lockwood School	1.06	.72	1.48	.60
Johnson Lane	.82	.81	1.48	.74
KGHL Station	.76	.38	.48	.28
City Hall	.54	.29	.42	.23
Bench School	.53	.53	.36	.21
Garden Avenue	.34	.24	.26	.14
CNR 33 & 2 Ave. N.	.43	.20	.27	.16
Mtn. View Blvd.	.41	.24	.30	.15
1200 Minn. Ave.	.95	.53	.88	.49
5th & S. 28th	.60	.55	.44	.30
Grand Ave. School	.53	.27		
S. 27th & 10 Ave. Sl.	.90	.52	.61	.44
East Conoco	.82	.78	1.01	.57
Two Moon Park	1.09	.70	1.31	.75
Newman School	.58	.33	.47	.22
Bench School			.36	.20
Klenck Lane	1.09	.68	1.31	.68
Piccolo & N. Ft. Rd.	1.41	1.14	2.18	1.29
Hi-Ball Trucking	1.25	.87		
Johnson & Lockwood	1.54	1.01	2.05	.88
Johnson Rd. N.	---	---	2.10	1.07
Woodland	.87	.68	1.39	.82
Coburn Road	1.33	.86	1.38	.85
Laurel Jr. Hi.	.29	.09	.09	.03
1 Mi. NE Coop	1.06	.53	1.02	.47
3/4 Mi. W. of Coop	.78	.53	.77	.54
St. John's Church	.32	.19	.28	.11
1/2 Mi. S. of Cenex	.66	.44	1.20	.60
E. of Laurel	1.81	1.01	.92	.62
Laurel Farm E. Cenex	2.19	1.12	1.32	.71
West Coop	.58	.29	.34	.17

*Values in excess of .5 indicate possible trouble spots and warrant continued sampling.

With the conclusion of the Montana Air Pollution Study in 1979, all monitoring for nitrogen dioxide, ozone, hydrocarbons, metals, sulfates and nitrates was terminated.

Billings winds tend to be primarily west southwest through west northwest, blowing the hardest during the winter months. The rimrocks tend to shelter the city when winds come from other directions and may prolong temperature inversions.

C. BUTTE

C. BUTTE

The Butte study area consists of several sites within Silver Bow County. Butte, at an elevation of 5,200 feet, is surrounded on three sides by the Continental Divide. The surrounding peaks make the area a prime candidate for temperature inversions. Due to Butte's high elevation, summers come late and falls arrive early. Precipitation for Silver Bow County ranges from 12 to 20 inches annually.

Butte-Silver Bow's population fluctuates greatly depending on operational changes in the mining industry. County population dropped 10 percent from 41,981 in 1970 to 37,950 in 1980. Future decreases in population may be seen due to the closure of the nearby copper smelter in Anaconda, and a reduction in the work force at the Berkeley Pit in Butte.

Major sources include:

1) Open pit copper mine (particulate)

2) Copper ore concentrator (particulate)

3) Elemental phosphorous plant (fluoride, particulate)

4) Tepee burner (fine particulate, CO)

5) Asphalt plants (particulate)

6) Automobiles (NOx, re-entrained particulate)

7) Wood stoves and fireplaces (fine particulate, CO)

Butte area sites are listed on Table C-I and are shown in Figure 1-C.

Table C-II summarizes TSP values for Butte area hi-vols. A portion of Butte was designated as a non-attainment area for TSP in 1978 (see Appendix C). Two sites (Greeley School and Hebgen Park) were in violation of the federal annual standard of 75 ug/m^3 in 1979, but dropped below the standard in 1980. In 1981 the Greeley School was again above the standard at 78 ug/m^3.

Table C-I

Butte Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Butte					
Greeley School	Silver Bow	State AQB	Population oriented	Center city - residential	Top of Greeley School Building on South Side
Hebgen Park	Silver Bow	State AQB	Population oriented	Center city - residential	Southeast side of Hebgen Park
Dr. Canty	Silver Bow	State AQB	Population oriented	Suburban - residential	Roof of 225 S. Clark
Walkerville					
Blaine School	Silver Bow	State AQB	Population oriented	Suburban - commerical	N. Main Street in Walkerville
Ramsay					
*Tierney Residence	Silver Bow	State AQB	Source oriented	Rural - industrial	SE Corner of Ramsey 0.8 mi NNW of Stauffer Chemical Company

*Site discontinued in 1981

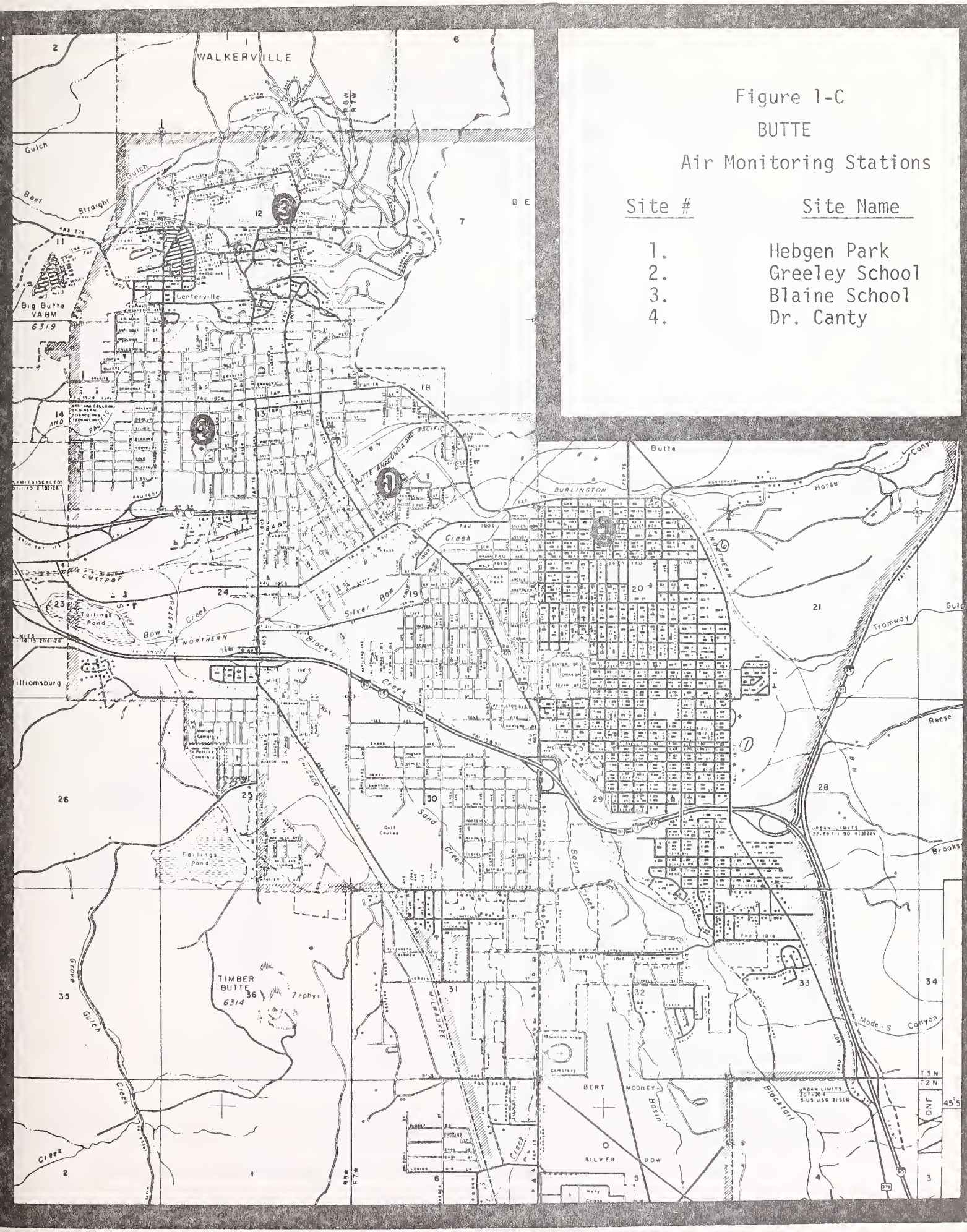


Figure 1-C

BUTTE

Air Monitoring Stations

Site #	Site Name
1.	Hebgen Park
2.	Greeley School
3.	Blaine School
4.	Dr. Canty

Table C-II
Butte Area - TSP
Micrograms Per Cubic Meter

Site	1980 Geo. Mean	1980 1-High	1980 2-High	1981 Geo. Mean	1981 1-High	1981 2-High
Dr. Canty Res.	66	322	192	49	245	228
Greeley School	72	220	209	78	346	247
Hebgen Park	74	252	224	65	263	177
Walkerville-Blaine School	*28	63	68	30	85	79
Ramsy - Tierney Res.	33	90	89	35	113	90

*Less than eight months of data.

Table C-III summarizes fluoride concentrations in the Ramsay area, west of Butte, where Stauffer Chemical is located. Fluoride concentrations are determined from the analysis of fluoride papers. The values are significantly higher than the guideline value of 0.30 ug/cm^2. High concentrations of fluoride can have devastating affects on both animals and vegetation. The Montana Board of Health and Environmental Sciences recently approved a vegetation standard for fluorides of 35 micrograms per gram (ug/g) grazing season average with no monthly average exceeding 50 ug/g.

Table C-III
Butte Area-Fluorides
Micrograms Per Square Centimeter - 30 Days*

Site	1980 Max	1980 Mean	1981 Max	1981 Mean
Ramsay West	.78	.56	1.10	.75
Ramsay North	.26	.24	.35	.20
Stauffer ESE	1.11	.80	3.31	1.48
South Stauffer	.64	.59	1.33	.74
South of Pond	.96	.58	1.41	.64
Ramsay Power Station	1.59	1.31	3.04	1.48
Stauffer West	.53	.32	.68	.38
West Stauffer Fence	--	--	.86	.61

*Prior to 1980 the AQB used a guideline of 0.30 ug/cm^2/30 days to indicate possible trouble spots

Nitrogen dioxide was monitored at the Hebgen Park site in 1980 and until May of 1981. Table C-IV lists high hourly concentrations and monthly means for NO_2 at the Hebgen Park site.

Table C-IV
Butte Area - Nitrogen Dioxide
Parts Per Million

	Hebgen Park - 1980		Hebgen Park - 1981	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.125	.026	.148	.040
Feb	.105	.029	.124	.025
Mar	.047	.016	.078	.014
Apr	.054	.015	.109	.009
May	.045	.013	.097	.013
Jun	.049	.012		
Jul	.033	.006		
Aug				
Sep				
Oct				
Nov	.043	.023		
Dec	.108	.023		
Annual Mean:		.019		.019

All monitoring in Butte for carbon monoxide, respirable paticulates, visibility, metals, sulfates and nitrates was discontinued in May of 1980. In addition, sampling for nitrogen dioxide and ozone was terminated during June of 1981. No ozone data was included due to numerous problems with the sampling equipment.

Butte area winds tend to be light (6 mph or less) and circular in pattern, a factor which contributes significantly to the high incidence of temperature inversions.

D. EASTERN MONTANA

D. EASTERN MONTANA

Eastern Montana air monitoring sites are generally considered those sites east of Billings. The data collected at Scobey as part of the Poplar River Project is presented in a later chapter. Table D-I lists the eastern Montana sites; Figure 1-D shows site locations.

The sites are primarily used to collect background data; however, the Miles City site is located to monitor urban particulate levels. The broad expanse of the area is primarily used for agricultural purposes and is sparsely populated. The elevations range from 2500 to 3500 feet. The climate tends to be harsh, with long cold winters and hot dry summers.

Pollution sources include:

1) Agriculture (particulate)

2) Coal development and mining (particulate)

3) Coal-fired power plants at Colstrip and Sidney (particulate, NOx, SO_2)

4) Gas sweetening plants (SO_2)

5) Oil well flares and vents (SO_2, H_2S)

6) Sugar beet refinery (particulates)

Table D-II summarizes TSP data for eastern Montana. The levels are generally low and do not approach the federal standards.

Table D-I

Eastern Montana Area
Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Lindsay					
*Weilgosh	Dawson	State AQB	Background	Rural-agricultural	Weilgosh Ranch NW of Lindsay
Decker					
*Thomas Ranch	Big Horn	State AQB	Background	Rural-agricultural	5 miles NE of Decker on SW shore of Tongue River Reservoir
Miles City					
PCA Building	Custer	State AQB	Population	City center - commercial	PCA Building
Glendive					
Dawson Comm. College	Dawson	State AQB	Background	Rural-near urban	Roof of Administration Building

*Site discontinued in 1981

Figure 1-D
EASTERN MONTANA
Air Monitoring Sites

#	Site Name
1.	Lindsay/Weilgosh
2.	Decker/Thomas Ranch
3.	Miles City PCA
4.	Glendive Dawson Comm. College

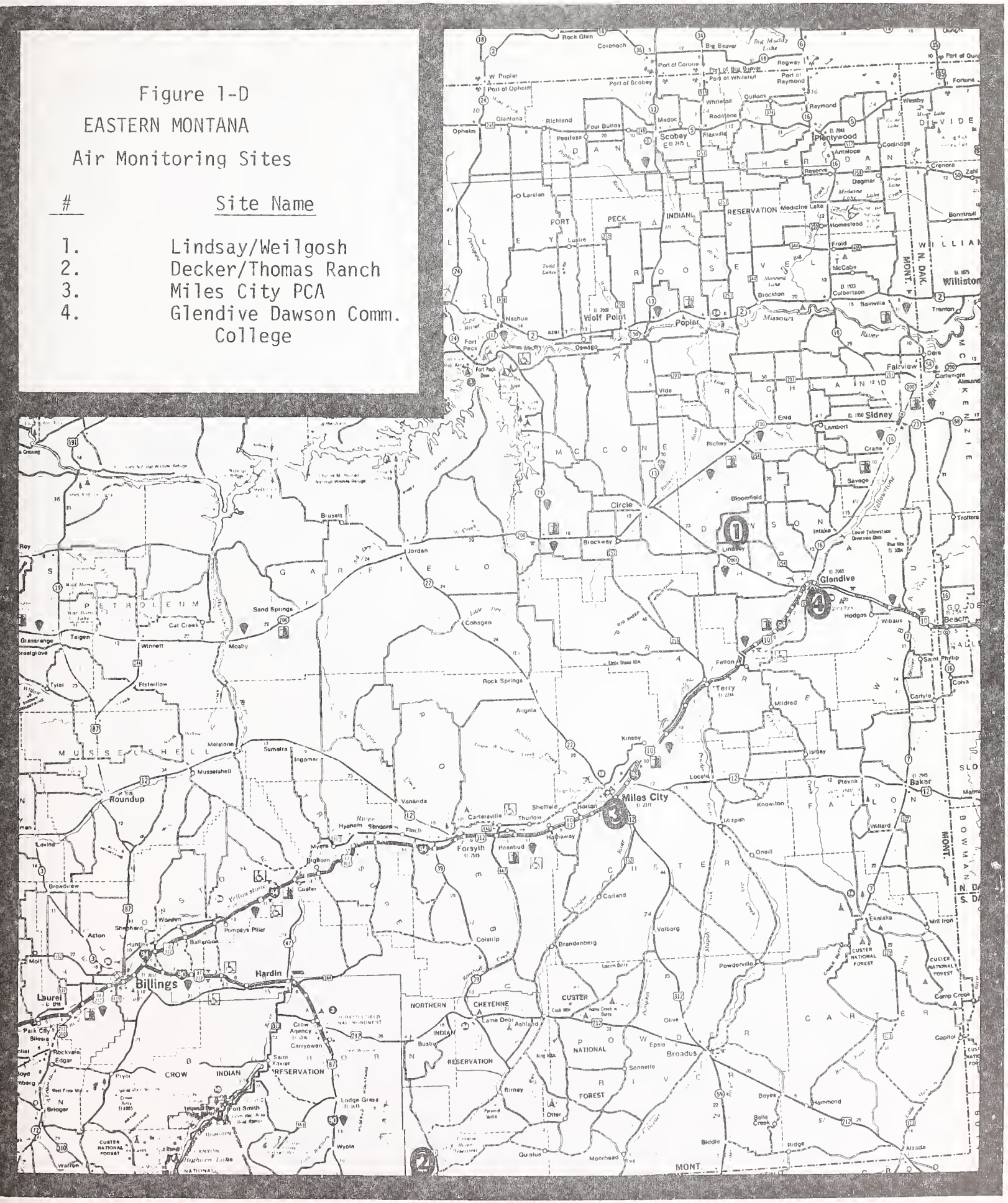

Billings
Miles City
Glendive
Sidney
Williston
Roundup
Hardin
Laurel
Forsyth
Terry
Baker
Wolf Point
Scobey
Circle
Brusett
Jordan
Winnett
Mosby
Sand Springs
Cohagen
Rock Springs
Angela
Melstone
Musselshell
Vananda
Carterville
Sheffield
Horton
Thurlow
Hathaway
Rosebud
Custer
Pompeys Pillar
Ballantine
Acton
Worden
Shepherd
Huntley
Broadview
Lavina
Myers
Bighorn
Hysham
Birdseye
Finch
Kinsey
Locate
Mildred
Felton
Hodges
Wibaux
Beach
Saint Phillip
Cohva
Carlyle
Isley
Plevna
Knowlton
Mizpah
Willard
Oneill
Carlend
Volborg
Brandenberg
Colstrip
Powderville
Ekalaka
Camp Crook
Capitol
Broadus
Olive
Epsie
Sonnette
Boyes
Hammond
Alzada
Ridge
Biddle
Moorhead
Quietus
Otter
Birney
Busby
Lame Deer
Ashland
Carrywood
Crow Agency
Saint Xavier
Pryor
Rockvale
Edgar
Park City
Silesia
Bridger
Fort Smith
Lodge Grass
Wyola
Warren
Big Horn Lake
Yellowstone
Custer
Cook City
Red Lodge
Roberts
Joliet
Molt
Broadview
Lavina
Melstone
Musselshell
Roy
Flatwillow
Tylet
Taigen
Cat Creek
Glassrange
Grassgrove
Petroleum
Garfield
McCone
Dawson
Prairie
Richland
Roosevelt
Valley
Phillips
Blaine
Hill
Liberty
Toole
Pondera
Teton
Chouteau
Cascade
Fergus
Judith Basin
Wheatland
Golden Valley
Sweet Grass
Stillwater
Carbon
Big Horn
Yellowstone
Treasure
Rosebud
Powder River
Carter
Fallon
Prairie
Wibaux
Dawson
Richland
Roosevelt
Sheridan
Daniels

Table D-II
Eastern Montana Area-TSP
Micrograms Per Cubic Meter

Site	1980			1981		
	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
Thomas Ranch - Decker	39	139	98	*29	64	59
Lindsay - Weilgosh	26	152	115	32	206	176
Glendive-Dawson College	*18	68	63	23	180	55
Miles City-PCA Bldg.	*55	158	148	52	145	129

*Less than eight months data

E. GREAT FALLS

E. GREAT FALLS

The Great Falls study area includes all sites in Cascade County. The county is located in the transition zone between the Rocky Mountains and the Northern Great Plains. As a consequence, it has climatic conditions common to both regions.

Great Falls is situated at the confluence of the Sun River with the Missouri River at an elevation of 3,300 feet. The city tends to be windy, with cold winters and hot summers. Temperature inversions are not as common as in the western valleys, but do occur.

Population counts decreased from 1970 to 1980 for both Cascade County and Great Falls. Cascade County decreased one percent from 81,804 to 80,639 while Great Falls decreased six percent from 60,091 to 56,105.

Table E-I lists monitoring sites for the Great Falls area; figure 1-E locates sites on a map of Great Falls.

Air pollution sources include:

1) Two grain mills (fine particulate)
2) An oil refinery (hydrocarbon, SO_2)
3) A copper refinery* (particulates)
4) Automobiles (NOx, CO, lead)
5) Home heating devices (fine particulate, CO, HC)

*The copper refinery was shut down in September 1980 as part of the closure of the copper smelter in Anaconda; however, on-going demolitions may cause emissions.

Table E-I
Great Falls Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Great Falls					
Kiwanis Park	Cascade	State AQB	Population-oriented	Center city-residential	Park bounded by 25th, 23rd street and 5th and 6th avenue
CCHD (City-County Health Department)	Cascade	*CCAPC	Source-oriented	Suburban-residential	Roof of City-County Health Department - 1130 17th Avenue South
Fire Station #1	Cascade	*CCAPC	Population-oriented	Center city-residential	9th Street and First Avenue South
Riverview Sch.	Cascade	*CCAPC	Population-oriented	Suburban-residential	Riverview School - 100 Smelter Avenue
Black Eagle	Cascade	*CCAPC	Population-oriented	Center city - commercial	Roof of Black Eagle Post Office
Lincoln School	Cascade	*CCAPC	Population-oriented	Suburban - commercial	625 27th Street
GF Federal	Cascade	*CCAPC	Source oriented	Suburban - commercial	Back of GF Federal Parking Lot-10th Ave. So.
Downtown	Cascade	*CCAPC	Source oriented	Center city - commercial	Roof of City Library 301 2nd Avenue North

*CCAPC - Cascade County Air Pollution Control

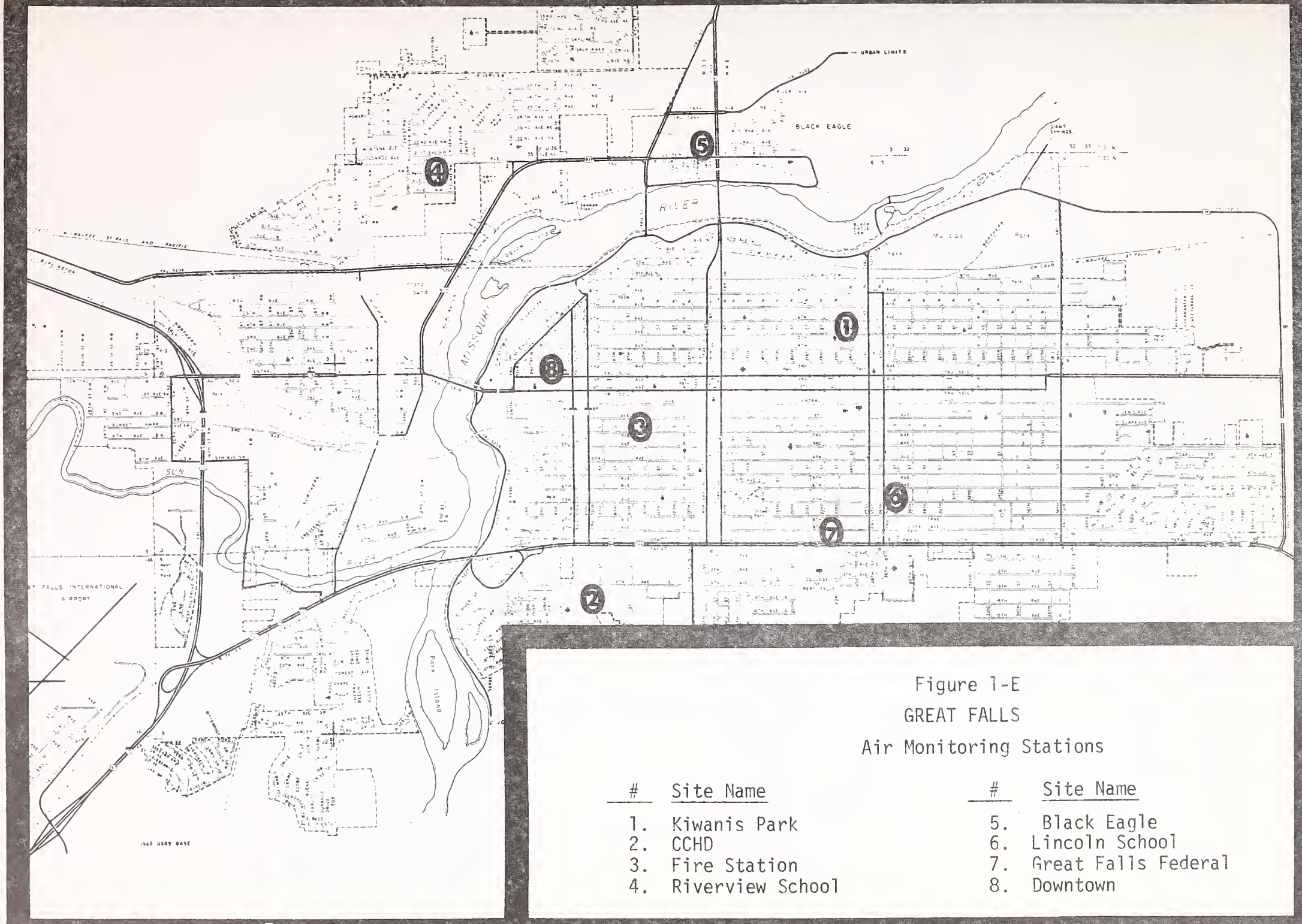


Figure 1-E

GREAT FALLS

Air Monitoring Stations

#	Site Name
1.	Kiwanis Park
2.	CCHD
3.	Fire Station
4.	Riverview School
5.	Black Eagle
6.	Lincoln School
7.	Great Falls Federal
8.	Downtown

Table E-II provides a summary of TSP data for Great Falls. No sites were in violation of the federal standards. The Fire Station site had the highest annual average of 69 ug/m^3 in 1981. Dustfall measurements at nine sites are listed on Table E-III.

Table E-II

Great Falls Area - TSP
Micrograms Per Cubic Meter

Site	1980			1981		
	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
GF - Black Eagle	*62	178	148	58	166	142
GF - Fire Station	72	194	191	69	291	192
GF - Downtown	*57	138	127	55	200	127
GF - CCHD	37	198	106	*43	157	87
Kiwanis Park	*36	103	92	43	131	117
GF - Lincoln School	*46	97	96	48	164	128
GF - Riverview	*58	199	135	45	141	124

*Less than eight months of data

Table E-III

Great Falls Area - Dustfall
Tons Per Square Mile

Site	1980		1981	
	Max	Annual Mean	Max	Annual Mean
Airport Industrial	15.25	3.70	8.54	* 2.77
Mountain States	48.08	19.65	63.84	25.65
Cascade Co. Health Dept.	4.83	2.41	4.27	* 4.27
Fire Station #1	23.93	9.03	18.24	10.83
West Hill	37.57	7.06	5.86	* 3.77
Sun River	10.27	3.73	.98	* .47
KOA Campground	12.15	4.58	8.74	* 2.84
ABBCO	--	--	4.77	* 1.86
4th St.S.W. & 4th Ave.S.W.	--	--	4.85	* 1.90

Montana Standard = 10 g/m^2/30 day average (28.5 Ton/Sq. mile)
*Less than eight months of data

During 1981, carbon monoxide was measured at the Great Falls Federal site along 10th Avenue South. In 1979 the sampling was done at 10th Avenue South and 9th Street. This site was used to designate the area non-attainment (see Appendix C). Due to a leasing problem, the site had to be relocated a short distance away on 10th Avenue South at the Great Falls Federal site. Table E-IV lists the highest one-hour and eight-hour concentrations and monthly means for the Great Falls Federal site.

Table E-IV
Great Falls Area - Carbon Monoxide
Parts Per Million

	Great Falls Federal - 1980			Great Falls Federal - 1981		
	1-Hour Max	Max 8-hour Mean	Monthly Mean	1-Hour Max	Max 8-hour Mean	Monthly Mean
Jan				8.7	7.8	2.2
Feb				6.3	4.8	1.4
Mar				5.7	4.3	1.6
Apr				4.5	2.9	0.9
May				2.1	1.6	0.5
Jun				2.5	2.2	0.5
Jul	2.5	1.7	.4	2.6	2.0	0.5
Aug	3.3	2.3	.7	3.6	2.1	0.6
Sep	10.4	4.6	1.0	4.2	2.2	0.4
Oct	5.0	3.3	1.2	4.8	2.3	0.8
Nov	8.2	4.3	1.4	7.1	4.0	0.9
Dec	13.3	10.1	1.4	10.5	7.4	1.3
Annual Mean:			1.0			1.0

With the conclusion of the MAPS study in 1980, monitoring terminated in Great Falls for respirable particulates, nitrogen dioxide, sulfur dioxide, metals, sulfates and nitrates.

F. HELENA
EAST HELENA

F. HELENA-EAST HELENA

The Helena-East Helena study area includes monitoring activities in Lewis and Clark and Jefferson Counties. Helena and East Helena are located at the southern end of the Helena Valley. The valley, approximately 40 miles in width and 4100-4300 feet in elevation, is bordered by mountain ranges on all sides. The cities of Helena and East Helena, like other cities in mountainous areas, are subject to frequent temperature inversions in winter months.

The area population rose 29 percent from 1970 to 1980 (Lewis and Clark County up 29 percent, 33,281 to 43,053; Helena up five percent, 22,730 to 23,818; East Helena down 0.5 percent, 1,651 to 1,643).

The area's monitoring sites are located on Figure 1-F and listed on Table F-I.

Pollution sources in the area include:

1) Primary lead smelter (lead, particulate, SO_2)

2) Copper oxide, zinc oxide manufacturer (Heavy metals, particulates)

3) Automobiles (NOx, CO, lead, re-entrained particulate)

4) Woodstoves and fireplaces (fine particulate, CO, organic HC)

Table F-II provides a summary of TSP data for Helena and East Helena. None of the sites which recorded a complete year of data registered an annual average for TSP in excess of the federal primary standard. However, based on less than four months data, the Hadfield site had a geometric mean of 80 ug/m^3.

Table F-1

Helena-East Helena Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Helena					
Cogswell Building	Lewis & Clark	State AQB	Population oriented	Center city - residential	Roof of Cogswell Building, Lockey & Sanders Streets
*Valley Bank	Lewis & Clark	L&C Health	Special study	Center city - industrial	Roof of Valley Bank on North Montana
Capital Courts	Lewis & Clark	L&C Health	Special study	Center city - residential	Roof of Capital Courts on Dearborn Avenue
*Sunhaven	Lewis & Clark	L&C Health	Special study	Center city - residential	Sunhaven District of Helena
East Helena					
Hastie	Lewis & Clark	State AQB	Source oriented	Center city - residential	212 E. Pacific Street
*A & W	Lewis & Clark	State AQB	Source oriented	Suburban - residential	Edge of Town, S of Hiway 12 Next to A & W
*Microwave	Jefferson	State AQB	Source oriented	Rural-agricultural	2 mi S. of ASARCO
Hadfield	Lewis & Clark	ASARCO-AQB	Source oriented population	Center city - residential	101 W. Main, East Helena
Dartman	Lewis & Clark	ASARCO-AQB	Source oriented	Suburban - residential	.5 mi N. of East Helena
*Schneider Res.	Lewis & Clark	State AQB	Source and population oriented	Suburban-residential	2580 Prickley Pear, East Helena

Table F-1 (continued)

Helena-East Helena Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
South	Lewis & Clark	ASARCO-AQB	Source oriented	Rural - agricultural	1 mi S. of East Helena
*Canal	Lewis & Clark	ASARCO-AQB	Source oriented	Rural - agricultural	0.5 mi E. of ASARCO smelter
*Vollmer	Lewis & Clark	ASARCO-AQB	Source oriented	Rural - agricultural	1.5 mi SE of ASARCO smelter
*Padbury	Lewis & Clark	ASARCO-AQB	Background	Rural - agricultural	1 mi E. of Helena
Montana City	Jefferson	AQB	Source and population oriented	Suburban - residential	On Montana City School

*Site discontinued in 1981

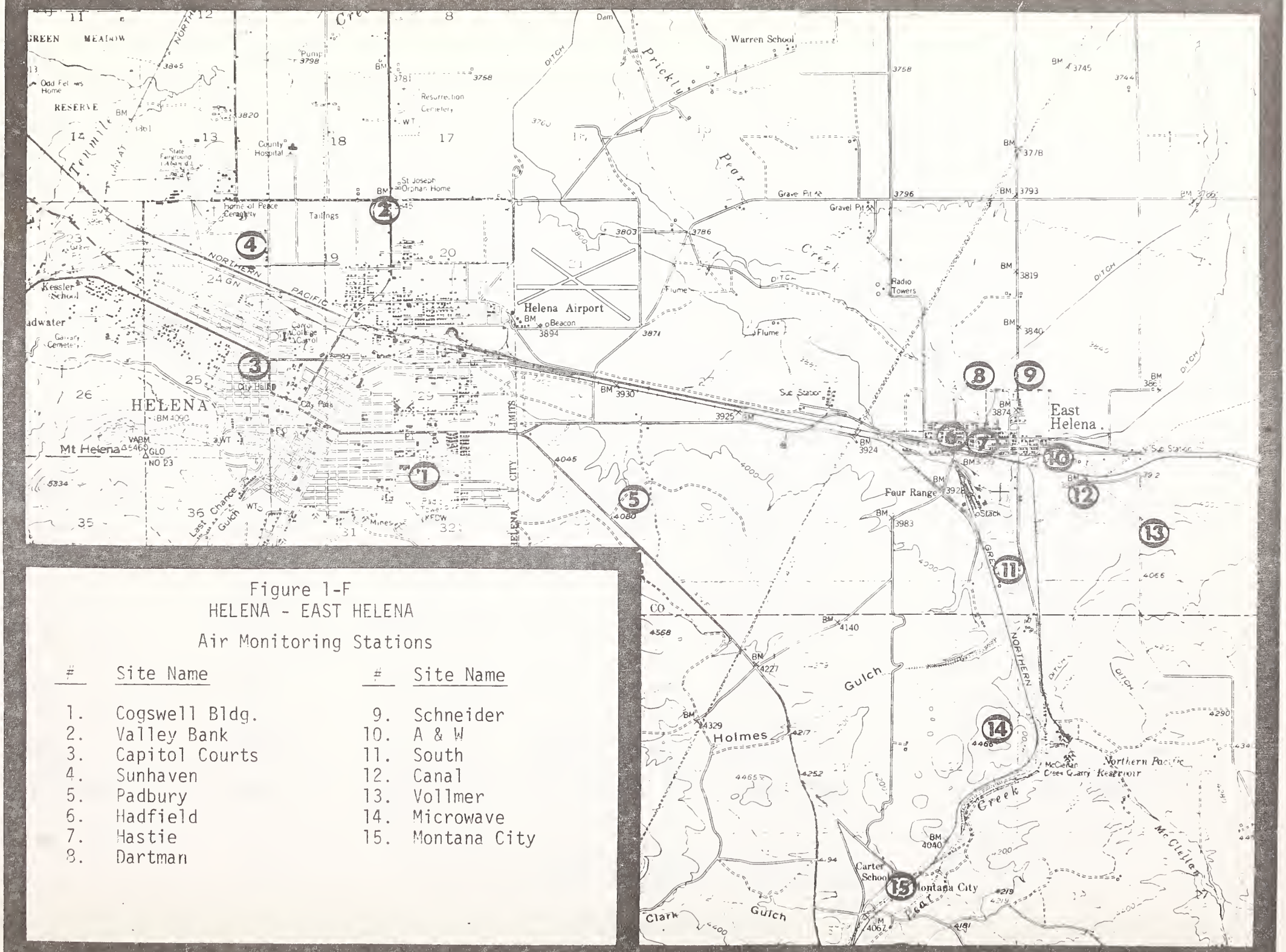


Figure 1-F
HELENA - EAST HELENA

Air Monitoring Stations

#	Site Name	#	Site Name
1.	Cogswell Bldg.	9.	Schneider
2.	Valley Bank	10.	A & W
3.	Capitol Courts	11.	South
4.	Sunhaven	12.	Canal
5.	Padbury	13.	Vollmer
6.	Hadfield	14.	Microwave
7.	Hastie	15.	Montana City
8.	Dartman		

Table F-II
Helena-East Helena - TSP
Micrograms Per Cubic Meter

Site	1980			1981		
	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
Helena-Cogswell	*59	199	163	40	191	121
Helena-Valley Bank	*55	156	153	42	250	128
Helena-Capital Courts	*70	244	149	52	248	220
Helena-Sunhaven	--	--	--	*48	108	86
E. Helena-Padbury	--	--	--	*33	126	108
E. Helena-Hadfield	--	--	--	*80	242	203
E. Helena-Hastie	86	346	160	67	230	209
E. Helena-Dartman	--	--	--	*44	112	107
E. Helena-A & W	67	194	156	55	267	190
E. Helena-South	--	--	--	*39	115	102
E. Helena-Canal	--	--	--	46	406	187
E. Helena-Vollmer	--	--	--	36	180	177
E. Helena-Microwave	--	--	--	25	63	54
E. Helena-Montana City	--	--	--	*73	422	240

*Less than eight months of data

Sulfur dioxide (SO_2) was monitored at one location near East Helena in 1981. Due to changes in the ASARCO smelter and monitoring costs, the AQB reduced its network to include only the A&W station, and even that was shut down in December of 1981. The AQB will receive data from the ASARCO SO_2 sites and perform audits to ensure compliance. Sulfur dioxide levels were quite low throughout 1981. A one-hour maximum of 0.498 ppm occurred in 1981. Table F-III summarizes the SO_2 data for 1980 and 1981.

Table F-III
Helena-East Helena - Sulfur Dioxide
Parts Per Million

	East Helena A & W 1980		East Helena A & W - 1981	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.260	.011	.498	.021
Feb	.090	.010	.328	.029
Mar	.115	.007	.338	.007
Apr	.200	.007	.172	.004
May	.032	.002	.122	.004
Jun	.065	.006	.076	.004
Jul	.140	.006	.045	.004
Aug	.320	.009	.308	.006
Sep	.133	.008	.237	.004
Oct	.245	.010	.134	.004
Nov	.334	.001	.153	.007
Dec	.504	.017	--	--
Annual Mean:		.008		.007

Table F-IV lists metal data obtained by chemical analyses of hi-vol filters from the East Helena area. Metal data is obtained by atomic absorption analysis. Among those sites having at least eight months of data in 1981, the annual lead concentration at the East Helena - Hastie site was the highest of all samplers in the state's network. The ASARCO lead smelter is probably the largest contributor with other sources being American Chemet and re-entrained dust. Quarterly averages for lead from this site exceed the Federal standard of 1.5 ug/m^3 for a calendar quarter. The quarterly standard was also exceeded at the Hadfield site. The annual concentrations of arsenic and cadmium are also the highest in the state; there are no standards for these metals.

Helena area winds are predominantly from the northwest through the southwest. Often during the winter months, the winds do not have sufficient velocity to blow out pollutants trapped in the valley by temperature inversions.

Table F-IV

Helena-East Helena Area - Metals
Micrograms Per Cubic Meter

Site		1981 Mean	1 High	2 High
Hastie	As(3)	.313	1.249	.720
	Cd(3)	.205	.648	.532
	Cu(3)	3.66	12.69	10.62
	Pb(12)	2.34	13.70	10.70
	Zn(3)	1.69	3.83	3.50
A&W	As(3)	.027	.072	.048
	Cd(3)	.054	.160	.113
	Cu(3)	1.24	3.28	1.83
	Pb(12)	.45	3.01	1.75
	Zn(3)	.34	.91	.65
Vollmer	As(3)	.059	.192	.168
	Cd(3)	.086	.386	.180
	Cu(3)	.46	.102	.102
	Pb(12)	.68	5.11	2.87
	Zn(3)	.58	1.50	1.48
Canal	As(3)	.073	.228	.192
	Cd(3)	.143	.698	.283
	Cu(3)	.083	2.16	1.46
	Pb(12)	.85	7.76	4.13
	Zn(3)	.73	3.32	1.12
Padbury	As(3)	.023	.072	.060
	Cd(3)	.018	.054	.053
	Cu(3)	.12	.26	.26
	Pb(8)	.19	1.03	.78
	Zn(3)	.20	.96	.77
South	As(3)	.108	.456	.360
	Cd(3)	.098	.498	.308
	Cu(3)	.52	2.82	2.51
	Pb(8)	1.16	6.09	5.69
	Zn(3)	.54	2.44	1.54
Hadfield	As(3)	.161	.432	.432
	Cd(3)	.170	.826	.527
	Cu(3)	3.04	13.94	10.57
	Pb(4)	3.22	10.10	7.83
	Zn(3)	1.01	3.35	2.28
Dartman	As(5)	.170	.840	.480
	Cd(5)	.163	.899	.677
	Cu(5)	2.43	11.52	9.39
	Pb(5)	1.87	13.74	5.90
	Zn(5)	1.02	4.70	2.37

Table F-IV (continued)

Helena-East Helena Area - Metals
Micrograms Per Cubic Meter

Site		1981 Mean	1 High	2 High
Valley Bank	Pb(12)	.17	1.01	.61
Montana City	Pb(3)	.12	.48	.33
Microwave	As(3)	.014	.048	.024
	Cd(3)	.031	.112	.097
	Cu(3)	.30	.68	.46
	Pb(9)	.14	.96	.52
	Zn(3)	.18	.80	.21

() - parentheses denotes number of sample months

G. MISSOULA

G. MISSOULA

The Missoula study area centers around the city of Missoula and is contained within Missoula County. The city is located at the confluence of the Clark Fork and Bitterroot Rivers at an elevation of 3,200 feet. The Missoula Valley floor forms a deep pocket with the surrounding mountains: Bitterroot Range to the west and southwest; Sapphire Mountains to the southeast, and the Reservation Divide to the north. The area is subject to severe temperature inversions during winter months which trap pollutants and allow concentrations to build up in the valley.

Population for the area increased substantially from 1970 to 1980; Missoula County increased 29 percent from 58,263 to 75,432, while the city increased 10 percent from 29,497 to 32,841. This dramatic increase influences Missoula Valley pollution problems.

Table G-I lists Missoula area air monitoring sites and Figure 1-G shows site locations.

Major sources in the area include the following:

1) Kraft paper mill (particulates, H_2S, other sulfur compounds)

2) One plywood plant (fine particulate and hydrocarbons)

3) Particle board plant (fine particulate, hydrocarbons)

4) Three sawmills (particulate)

5) Automobiles (NOx, CO, re-entrained particulate)

6) Woodstoves and fireplaces (CO, fine particulate and hydrocarbons)

Table G-1
Missoula Area - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Missoula Courthouse Roof	Missoula	**MCCHD	Population oriented	Center city - commercial	City-County Courthouse-Corner of Woody Street & W Pine
Rose Park	Missoula	**MCCHD	Population oriented	Center city - residential	NE Side Sunset Memorial Park - 1/2 blk from Hiway 93S
*McLeod Park	Missoula	State AQB	Population oriented	Center city - residential	Park approx. 4 blks W. of Hiway 93 S
*Schilling Street	Missoula	**MCCHD	Population oriented	Suburban - residential	Corner of Shilling & Davidson Street
Malfunction Jct.	Missoula	State AQB	Population oriented	Center city - mobile	Junction of Brooks, Russell & South Avenue
Missoula County HW#1	Missoula	**MCCHD	Source oriented	Rural-industrial	Railroad bluff near Hoerner Waldorf
Missoula County HW#2	Missoula	**MCCHD	Source oriented	Rural-industrial	Well Field
Boyd Park	Missoula	**MCCHD	Population oriented	Suburban-residential	Washburn and Ernest Avenue

*Site discontinued in 1981
**MCCHD - Missoua City-County Health Department

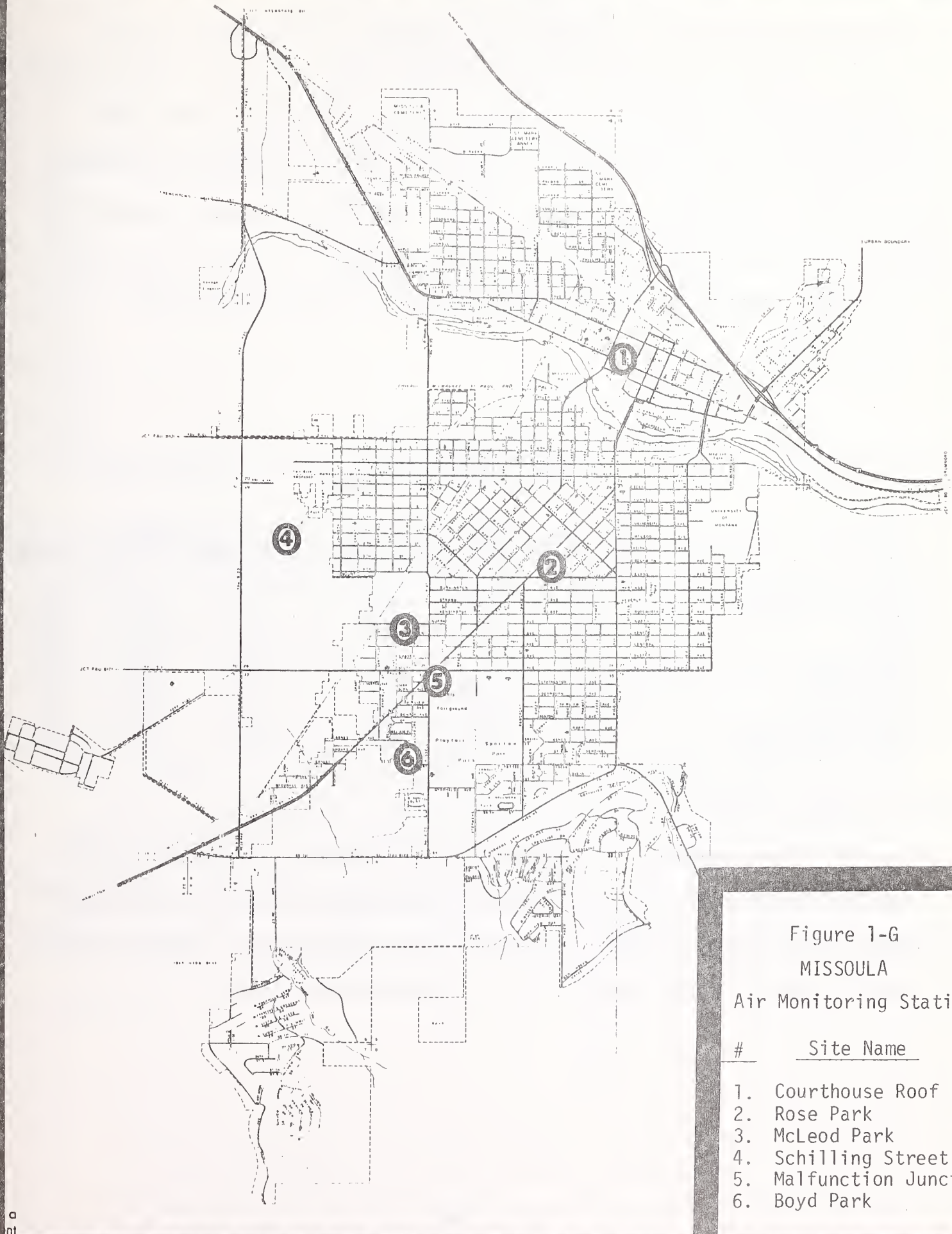


Figure 1-G

MISSOULA

Air Monitoring Stations

#	Site Name
1.	Courthouse Roof
2.	Rose Park
3.	McLeod Park
4.	Schilling Street
5.	Malfunction Junction
6.	Boyd Park

Table G-II summarizes TSP data for the Missoula hi-vol sites. Missoula has consistently had some of the highest TSP readings in the state. In 1977 Missoula was designated non-attainment for TSP (see Appendix C). This was due to high readings (in excess of the Federal 24-hour standard of 260 ug/m^3) throughout the year. 1981 was the first year since 1975 that all sites with sufficient data showed annual averages below the Federal primary standard (75 ug/m^3). However, based on only a few months data, TSP levels at Boyd Park, Schilling Street and McLeod Park were averaging 81, 102 and 100 ug/m^3 respectively.

Table G-II
Missoula Area - TSP
Micrograms Per Cubic Meter

	1980			1981		
Site	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
Courthouse Roof	78	357	286	62	220	216
HW #1	33	213	171	25	106	96
HW #2	33	211	209	25	122	100
Boyd Park	--	--	--	*81	195	160
McLeod Park	*101	406	374	*100	146	111
Rose Park	79	382	292	56	208	187
Schilling Street	98	464	444	*102	358	272

*Less than eight months data

Respirable particulates (Table G-III) were measured during 1981 at the Courthouse Roof site. These readings were relatively high when compared with other sites around the state. It is felt that the respirable fraction relates more to health effects than the total suspended particulates.

Table G-III
Missoula Area - Respirable Particulates
Courthouse Roof 1981
Micrograms per Cubic Meter
Size Classification - Microns

Month	<2.5		2.5-15		>15	
	Max	Mean	Max	Mean	Max	Mean
Jan	34.5	24.3	34.0	20.1	63.0	44.4
Feb	19.5	11.7	27.4	20.5	38.6	32.2
Mar	21.2	15.8	37.7	23.4	57.5	39.3
Apr	21.6	13.8	35.8	22.8	57.4	36.6
May	12.8	11.5	22.7	18.9	35.5	30.4
Jun						
Jul						
Aug						
Sep						
Oct						
Nov						
Dec						
Annual Mean:		15.9		21.4		37.3

In addition to measuring particulate matter with hi-vols and dichotomous samplers, Missoula county uses an aerosol mass monitor (beta counter) to give real time hourly readings of particulate concentrations. This data corresponds fairly well with RP and TSP and is used by county personnel for episode monitoring when high readings occur. No summary of this data is presented in this report; however, it is available upon request.

Missoula sulfate data are presented in Table G-IV. Chemical analysis methods are used to obtain this data from hi-vol filters. Sulfate levels in Missoula appear to be similar to other small cities. The levels at the HW#1 and HW#2 sites, however, are elevated for a rural area; probably due to the nearby kraft pulp mill.

Table G-IV
Missoula Area - Sulfate
Micrograms Per Cubic Meter

Site	1980 Mean	1980 1-High	1980 2-High	1981 Mean	1981 1-High	1981 2-High
Courthouse Roof	4.8(7)	15.4	9.7	2.9(6)	6.5	5.9
Rose Park	--	--	--	2.1(3)	6.5	5.4
HW#1	--	--	--	3.7(2)	8.6	5.9
HW#2	--	--	--	2.6(2)	5.8	4.9

( ) - parentheses denotes number of sample months.

Monitoring for ozone, nitrogen dioxide, total hydrocarbons and metals was discontinued in 1980.

Part of the city of Missoula was designated non-attainment for CO due to high concentrations in the past (see Appendix C). Sampling of CO was conducted at four sites in 1981. The Downtown and Malfunction Junction sites showed violations of the eight-hour 9 ppm standard. These high CO concentrations are usually due to automobile emissions. In recent years, Missoula has recorded CO levels in residential areas, such as Boyd Park, very close to the eight-hour standard (8.5 ppm). This is probably due to an increased use of wood burning devices in homes. Table G-V presents the CO data for the Missoula area.

Table G-V
Missoula Area - Carbon Monoxide
Parts Per Million

Month	Malfunction Junction - 1980 1-hour Max	Malfunction Junction - 1980 Max 8-hour Mean	Malfunction Junction - 1980 Monthly Mean	Malfunction Junction - 1981 1-hour Max	Malfunction Junction - 1981 Max 8-hour Mean	Malfunction Junction - 1981 Monthly Mean
Jan	11.5	9.5	3.4	11.8	9.2	3.4
Feb	13.0	10.4	4.0	12.3	11.7	2.9
Mar	8.5	5.7	2.7	8.0	6.6	2.9
Apr	7.0	5.8	2.5	7.8	7.0	2.5
May	7.5	5.9	2.7	7.8	6.4	3.0
Jun	7.8	6.2	3.2	7.5	6.9	3.6
Jul	7.8	7.0	3.0	6.5	6.2	3.3
Aug	6.8	5.7	2.8	4.3	3.0	0.9
Sep	9.5	7.7	3.4	4.5	3.1	1.2
Oct	9.5	6.1	3.2	8.0	5.1	1.2
Nov	11.0	8.6	3.7	9.5	7.3	2.5
Dec	17.3	15.2	5.2	7.3	6.6	4.1
Annual Mean:			3.3			2.3

Table G-V (Continued)
Missoula Area - Carbon Monoxide
Parts Per Million

Month	Rose Park - 1980 1-hour Max	Rose Park - 1980 Max 8-hour Mean	Rose Park - 1980 Monthly Mean	Rose Park - 1981 1-hour Max	Rose Park - 1981 Max 8-hour Mean	Rose Park - 1981 Monthly Mean
Jan				5.0	3.3	1.4
Feb				10.6	8.4	1.2
Mar				4.8	2.5	1.0
Apr				7.3	2.7	1.4
May				4.5	1.4	0.4
Jun				6.4	1.0	0.1
Jul				1.8	1.0	0.4
Aug				6.5	1.4	0.9
Sep				4.8	2.6	0.4
Oct				9.1	5.8	0.9
Nov				11.0	7.7	2.4
Dec	12.5	11.4	2.4	8.8	5.5	1.6
Annual Mean:			2.4			0.9

Month	Downtown - 1980 1-hour Max	Downtown - 1980 Max 8-hour Mean	Downtown - 1980 Monthly Mean	Downtown - 1981 1-hour Max	Downtown - 1981 Max 8-hour Mean	Downtown - 1981 Monthly Mean
Jan				19.0	11.7	3.6
Feb				26.1	12.5	3.9
Mar				21.0	0.8	2.7
Apr				13.8	6.8	1.7
May				25.8	14.5	2.8
Jun				14.8	8.0	3.9
Jul	22.8	11.4	2.0			
Aug	23.3	8.6	1.9			
Sep	21.8	11.0	2.6			
Oct						
Nov						
Dec	12.3	8.6	3.5			
Annual Mean:			2.2			3.1

Table G-V (Continued)
Missoula Area - Carbon Monoxide
Parts Per Million

Boyd Park - 1981

Month	1-Hour Max	Max 8-hour Mean	Monthly Mean
Jan			
Feb			
Mar			
Apr			
May			
Jun			
Jul			
Aug	3.1	2.3	1.2
Sep	4.0	3.0	0.8
Oct	14.3	4.5	1.2
Nov	11.7	8.5	2.3
Dec	10.9	7.5	2.3
Annual Mean:			1.6

Wind in Missoula tends to be southwesterly most of the year. It is generally of low speed (1-2 m/sec) and unable to break up temperature inversions.

H. NORTHWESTERN MONTANA

H. NORTHWESTERN MONTANA

The Air Quality Bureau's activities in Northwestern Montana center around the Flathead River Basin Environmental Impact Study. Several sites are operated in Flathead and Lake Counties as part of this project; another site is located in Libby. Table H-I lists the air monitoring sites; Figure 1-H shows the site locations. Figure 2-H shows the Flathead River Basin Study area.

The Flathead Study was authorized by Congress and funded through the Environmental Protection Agency. Air quality is only one portion of the study; other parts include studies of limnology, sedimentation, fisheries, recreation, riparian habitat and soil permeability. The study is in its fifth and final year.

The air quality portion of the study was precipitated by developments which might affect air quality in Glacier National Park and the Flathead Valley. The developments include the following:

1) U.S. and Canadian industrial development and mining operations -- particularly the Cabin Creek coal mine in British Columbia;

2) Population and recreational growth--In 1980 Kalispell's population decreased slightly to 10,299 from 10,526 in 1970, while Flathead County increased by 30 percent from 39,460 in 1970 to 51,462 in 1980.

The topography of the Flathead and Libby Valleys is very similar to the Missoula Valley. The inhabited areas, around 3000 feet in elevation, are surrounded by mountains reaching 8-10,000 feet. As a result temperature inversions and poor ventilation are common; this is especially evident during the winter months.

Table H-I

Northwestern Montana - Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Libby Brown Residence	Lincoln	State AQB	Population oriented	Center city - residential	Corner of Larch & Dakota - 1/2 Block from St. Regis & 4 lane paved road
Polebridge	Flathead	State AQB	Special project	Remote	Polebridge Ranger Station in Glacier Park
Whitefish	Flathead	State AQB	Special project	Suburban-residential	In the city Park at Pine & 3rd
Columbia Falls NAAC	Flathead	State AQB	Source oriented	Rural - agricultural	1/2 mi NW of Anaconda Alum.
Anders	Flathead	State AQB	Population oriented	Center city - residential	726 First Avenue East
Glacier Int. Airport	Flathead	State AQB	Special project	Rural-agricultural	Near airport headquarters
Kalispell Evergreen	Flathead	State AQB	Special project	Suburban-residential	Evergreen Rural Cooperative Bldg.
Universal Athletic	Flathead	State AQB	Population	Center city - commercial	Roof of Universal Athletic Supply -226 Main Street
Big Fork	Flathead	State AQB	Special project	Suburban - residential	Big Fork Ranger Station W. side of Hwy 35
Swan River	Lake	State AQB	Special project	Remote	Swan River Youth Camp 15 mi S of Swan Lake
Polson	Lake	State AQB	Special project	Rural - agricultural	2 mi E of Polson near Hwy 93
Ronan Ninepipes	Lake	State AQB	Special project	Rural - agricultural	1 mi S of Ronan near Hwy 93

Figure 1-H

NORTHWESTERN MONTANA
Air Monitoring Stations

#	Site Name	#	Site Name
1.	Libby-Browns	7.	Kalispell-Evergreen
2.	Polebridge	8.	Kalispell-Univ. Athletics
3.	Whitefish	9.	Big Fork
4.	Columbia Falls-NAAC	10.	Swan River
5.	Columbia Falls - Anders	11.	Polson
6.	Glacier Int. Airport	12.	Ronan - Ninepipes

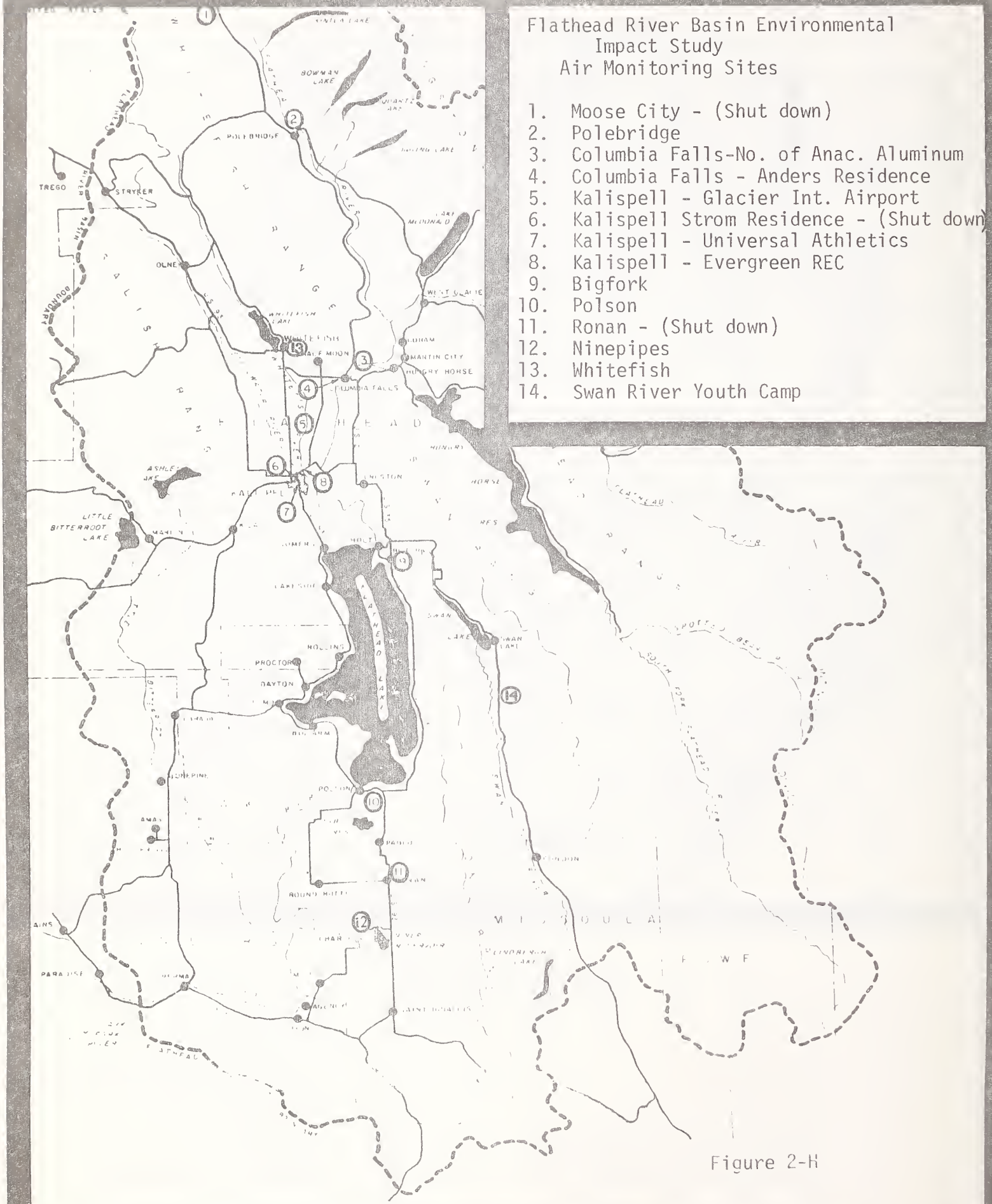

Flathead River Basin Environmental
Impact Study
Air Monitoring Sites
1. Moose City - (Shut down)
2. Polebridge
3. Columbia Falls-No. of Anac. Aluminum
4. Columbia Falls - Anders Residence
5. Kalispell - Glacier Int. Airport
6. Kalispell Strom Residence - (Shut down)
7. Kalispell - Universal Athletics
8. Kalispell - Evergreen REC
9. Bigfork
10. Polson
11. Ronan - (Shut down)
12. Ninepipes
13. Whitefish
14. Swan River Youth Camp
FLATHEAD
MISSOULA
LAKE

Figure 2-H

Sources of pollution by county include the following:

Flathead County

1) Aluminum reduction plant (fluoride, particulates, SO_2)
2) Two plywood plants (particulates, HC)
3) Particle Board Plant (particulates, HC)
4) Seven sawmills (particulates, CO)
5) Four asphalt plants (particulates)

Lake County

6) Two sawmills (particulates, CO)

Lincoln County

7) Plywood plant (particulates, HC)
8) Two sawmills (particulates, CO)
9) Copper- Silver copper mine (particulates)

All Counties

10) Automobile (particulates, CO)
11) Slash and open burning (particulates, CO)
12) Residential wood combustion (particulates, CO)

Table H-II summarize TSP levels in this portion of the state. The Libby site recorded the highest annual average in the state (120 ug/m^3). The Libby site violated both the Federal 24-hour and annual standards during 1981. Sites in Columbia Falls and Kalispell were also above the Federal annual standard of 75 ug/m^3.

Table H-II
Northwestern Montana - TSP
Micrograms Per Cubic Meter

	1980			1981		
SITE	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
Big Fork	36	134	102	28	109	84
Ronan-Ninepipes	18	42	35	18	142	55
Polson	55	519	177	36	174	111
Glacier Int. Airport	48	309	232	32	134	103
Flathead - NAAC	25	106	81	25	89	83
Kalispell - Evergreen	*59	169	138	53	170	159
Kalispell - Univ. Athletics	92	296	202	81	211	186
Libby - Brown	128	306	269	120	444	378
Col. Falls - Anders	99	498	455	108	494	390
GNP - #5	*18	81	74	13	69	59
GNP - #8	*12	49	38	* 6	23	20
Swan River				* 6	6	6
Whitefish				*67	144	128

*Less than eight months data

Respirable particulates (Table H-III) are measured by a dichotomous sampler. These devices separate particulates into two sizes--fine (<2.5 microns) and coarse (2.5-15 microns). It is felt that these small particles have the most potential impact on health.

Table H-III
Northwestern Montana - Respirable Particulates
Micrograms Per Cubic Meter
Size Classification Microns

		<2.5		2.5-15		<15	
Site	Year	Max	Mean	Max	Mean	Max	Mean
Kalispell Univ. Athl.	80(12)	80.8	20.6	203.5	46.3	283.1	65.6
	81(12)	40.1	17.3	114.7	41.1	126.8	58.4
Polson	80(12)	39.7	13.5	84.3	15.2	109.1	28.8
	81(7)	25.0	12.1	34.2	12.1	42.3	24.2
Col. Falls-Anders	80(12)	94.9	18.7	235.5	51.9	263.5	70.4
	81(3)	58.5	27.5	113.6	45.3	141.9	72.8
Flathead Airport	80(12)	44.5	16.6	174.3	26.5	198.2	45.4
	81(12)	32.2	11.4	99.3	16.8	129.0	28.0
Ronan-Ninepipes	81(12)	44.8	7.6	66.0	8.5	83.6	16.1
Polebridge	80(12)	12.2	4.5	13.9	3.2	21.6	7.8
	81(3)	8.1	3.8	16.9	3.2	23.5	7.0

( ) - parentheses denotes number of sample months

Fluoride is emitted by the Anaconda Aluminum plant near Columbia Falls and is measured in the Columbia Falls and Glacier National Park areas (Table H-IV). The Montana State Board of Health and Environmental Sciences recently approved a vegetation standard for fluoride of 35 micrograms per gram (ug/g) grazing season average with no monthly average to exceed 50 ug/g. Although previous sampling methods (calcium formate papers and sodium formate plates) are not applicable to the new standard, they do indicate high ambient levels.

Table H-IV
Northwestern Montana - Fluorides
Calcium Paper-Micrograms/Sq. Cm - 30 Days

Site	1980 Max	1980 Mean	1981 Max	1981 Mean
Dehlbom Residence	.41	.30	.51	.26
Fierstein	.23	.17	.22	.11
RE Owens	.17	.13	.19	.11
Badrock Substation	.41	.24	.28	.17
Dehlbom Field	.61	.36	.54	.23
Anaconda South	4.82	2.37	6.09	1.62
Teakettle Mtn #1	1.52	1.05	1.04	.65
Teakettle Mtn #8	.25	.17	.22	.12
Aluminum City	.84	.53	1.33	.32
NAAC	.37	.25	.42	.19

Sulfates and nitrates (Table H-V) are measured by chemical analysis of high volume filters. These parameters serve as indicators of gaseous pollutants--sulfate of SO_2 and SO_3 and nitrate of NO, NO_2, and NO_3.

Table H-V
Northwestern Montana Sulfates & Nitrates
Parts Per Million

Site		1980 Mean	1980 1-High	1980 2-High	1981 Mean	1981 1-High	1981 2-High
Polebridge	NO_3				0.1(8)	0.4	0.3
	SO_4				3.2(8)	4.9	4.9
Big Fork	NO_3	0.7(12)	3.9	3.8	0.7(12)	3.0	2.8
	SO_4	3.4(12)	8.0	6.5	2.4(12)	6.5	5.1
Whitefish	NO_3				1.0(5)	2.0	1.7
	SO_4				2.5(5)	4.7	4.3
Kalispell Universal Athletics	NO_3	1.3(12)	5.9	5.5	1.1(12)	3.8	3.7
	SO_4	4.6(12)	8.8	7.1	4.2(12)	8.0	7.9
Lake - Polson	NO_3	1.0(12)	3.5	3.1	0.9(12)	3.8	3.4
	SO_4	3.9	6.6	6.6	2.7(12)	6.6	6.2
Ronan-Ninepipes	NO_3				0.8(12)	3.4	3.0
	SO_4				1.6(12)	4.9	4.4
Swan River	NO_3				0.0(1)	0.0	0.0
	SO_4				1.9(1)	2.1	1.8

() - parentheses denotes the number of sample months

Visibility was measured at Glacier International Airport. The standard (3×10^{-5}/meters) applies only to mandatory Class I attainment areas which include national parks and wilderness areas. It equates roughly to being able to see objects clearly at a minimum distance of 21 miles. The data is not summarized in this report, but is available on request.

For a more comprehensive analysis of the data from this area, a copy of the Flathead River Basin EIS Interim Annual Report, June 1981, can be obtained from the Bureau.

I. CENTRAL MONTANA

I. CENTRAL MONTANA

Central Montana air monitoring sites have been grouped together to include those sites in Bozeman, Havre and Lewistown. Prior to 1980, only one site was in operation in these three cities; this was the Traphagen site in Bozeman. As a result of the 1979 Network Review, the Bureau decided to install one hi-vol each in Lewistown and Havre and two more in Bozeman. Table I-I lists the central Montana sites; Figure 1-I shows the site locations.

Bozeman's population increased nearly 16 percent from 1970 to 1980 (18,670 to 21,611) while Gallatin County increased 32 percent in the same time period (32,505 to 42,821). Havre and Lewistown had only moderate increases. Havre's population increased from 10,558 to 10,842 in the decade, while Lewistown's went from 6,437 to 7,709.

The three cities are all centers of agricultural activity for their areas. Bozeman is the home of Montana State University with an enrollment of about 10,000 students. There are no major industries in any of the cities.

The elevations of the cities are as follows: Bozeman, 4800 feet; Lewistown, 4000 feet; Havre, 2500 feet. Bozeman and Lewistown have similar climates: weather and wind patterns (usually calm) are dictated by local mountainous terrain; each receives about 20 inches of precipitation a year. Havre's climate tends to be more harsh; the winters tend to be cold and windy and the summers hot and dry. Havre receives about 12 inches of precipitation annually. All cities are east of the Continental Divide and experience chinook winds.

Table I-I

Central Montana Area Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Bozeman					
Traphagen	Gallatin	State AQB	Population oriented	Center city - residential	Traphagen Hall, MSU
E. Main	Gallatin	State AQB	Population oriented	Center city- commercial	34 No. Rouse Street
*MSU Family Housing	Gallatin	State AQB	Population oriented	Suburban- residential	MSU Family Housing 19th & College
Whittier School	Gallatin	State AQB	Population oriented	Center city - residential	Whittier School Peach & 5th Street
Havre					
City Bldg.	Hill	State AQB	Population oriented	Center city- residential	520 4th Street
Lewistown					
Downtown	Fergus	State AQB	Population oriented	Center city- commercial	Roof of Midstate Bank 450 W. Janeaux

*Site discontinued in 1981

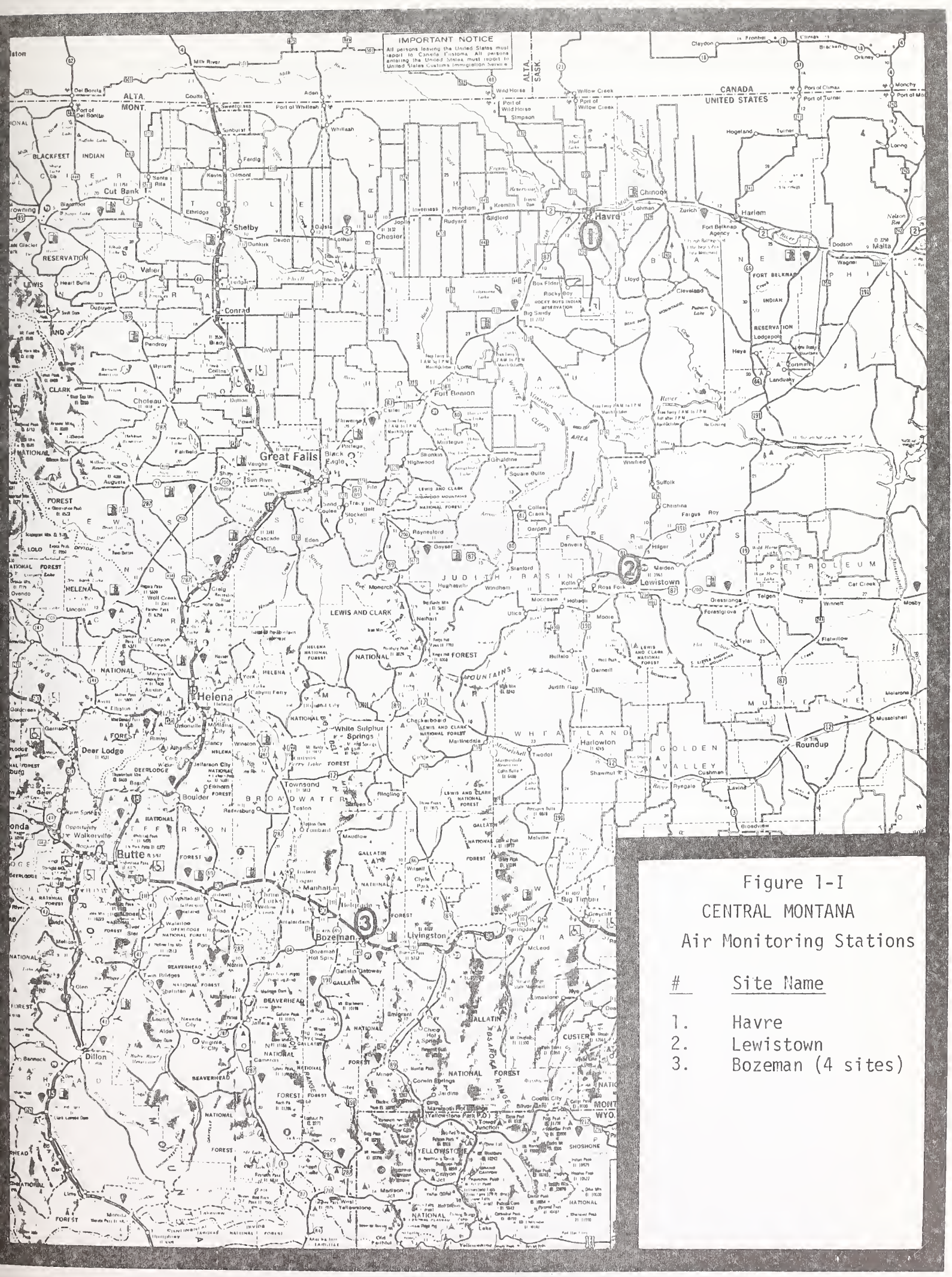


Figure 1-I
CENTRAL MONTANA
Air Monitoring Stations

#	Site Name
1.	Havre
2.	Lewistown
3.	Bozeman (4 sites)

Pollution sources for all three cities include:

1) Agricultural (particulate)

2) Paved and unpaved roads (particulate)

3) Home heating devices (fine particulate, CO, HC)

Table I-II summarizes TSP data for central Montana. The only site of any major concern is the Bozeman-East Main site. This site registered a relatively high geometric mean of 68 ug/m^3. The MSU Family Housing site was moved to the Whittier School in December of 1981.

Table I-II

Central Montana Area - TSP
Micrograms Per Cubic Meter

	1980			1981		
Site	Geo. Mean	1-High	2-High	Geo. Mean	1-High	2-High
Havre-Central Bldg.	*49	124	117	59	162	145
Lewistown - Downtown	*58	144	142	*62	130	116
Bozeman-Traphagen	36	117	115	25	69	60
Bozeman-E. Main	*102	337	281	68	246	194
Bozeman-MSU Family Housing	*58	179	172	*57	398	350
Bozeman-Whittier School				*56	89	74

*Less than eight months data

J. POPLAR RIVER

J. POPLAR RIVER

The Poplar River Study in Daniels County began in March, 1977 to gather background data prior to the start-up of a two unit coal-fired power plant at Coronach, Saskatchewan. The first 300 megawatt unit was originally scheduled to go on line in December 1979. Due to construction delays, the plant did not start up until October, 1980. The second unit is scheduled to go on line in November of 1982.

The Poplar River project was funded by the Federal Government until June, 1981; funding has now been picked up by the State with the project expected to continue until June, 1983.

Air quality in the Scobey-Poplar River area is fairly representative of the entire northeast corner of the state. The area is part of the Northern Great Plains with an elevation of 2000-2500 feet. It tends to have cold, hard winters with persistent high winds. Precipitation for the area averages 12-14 inches per year.

Population for the northeast corner of the state tends to be sparse. Population counts for Daniels, Roosevelt, and Sheridan counties totaled 18,663 in 1980.

Pollution sources for the Scobey area include:

1) Agriculture (particulates)

2) Canadian coal-fired power plant (particulates, SO_2, NOx)

Table J-I provides the monitoring site descriptions for this area and Figure 1-J shows the locations.

TSP (Table J-II) levels are well below national standards. However, occasional high levels occur due to wind-blown dust from summer-fallowing and other agricultural practices. The levels encountered at the Scobey sites compare favorably with other background sites throughout eastern Montana.

Table J-I

Poplar River Area Monitoring Site Descriptions

Site Name	County	Responsible Agency	Project	Station Type	Location/Comments
Scobey Border Site	Daniels	State AQB	Background surveillance	Rural - agricultural	80 yards west of the US Customs Office
Richardson	Daniels	State AQB	Background surveillance	Rural-near urban	1 mi N of Scobey near Hwy 13
Hanrahan	Daniels	State AQB	Background surveillance	Rural - agricultural	SE Corner, Sec. 3, T36N, R49E

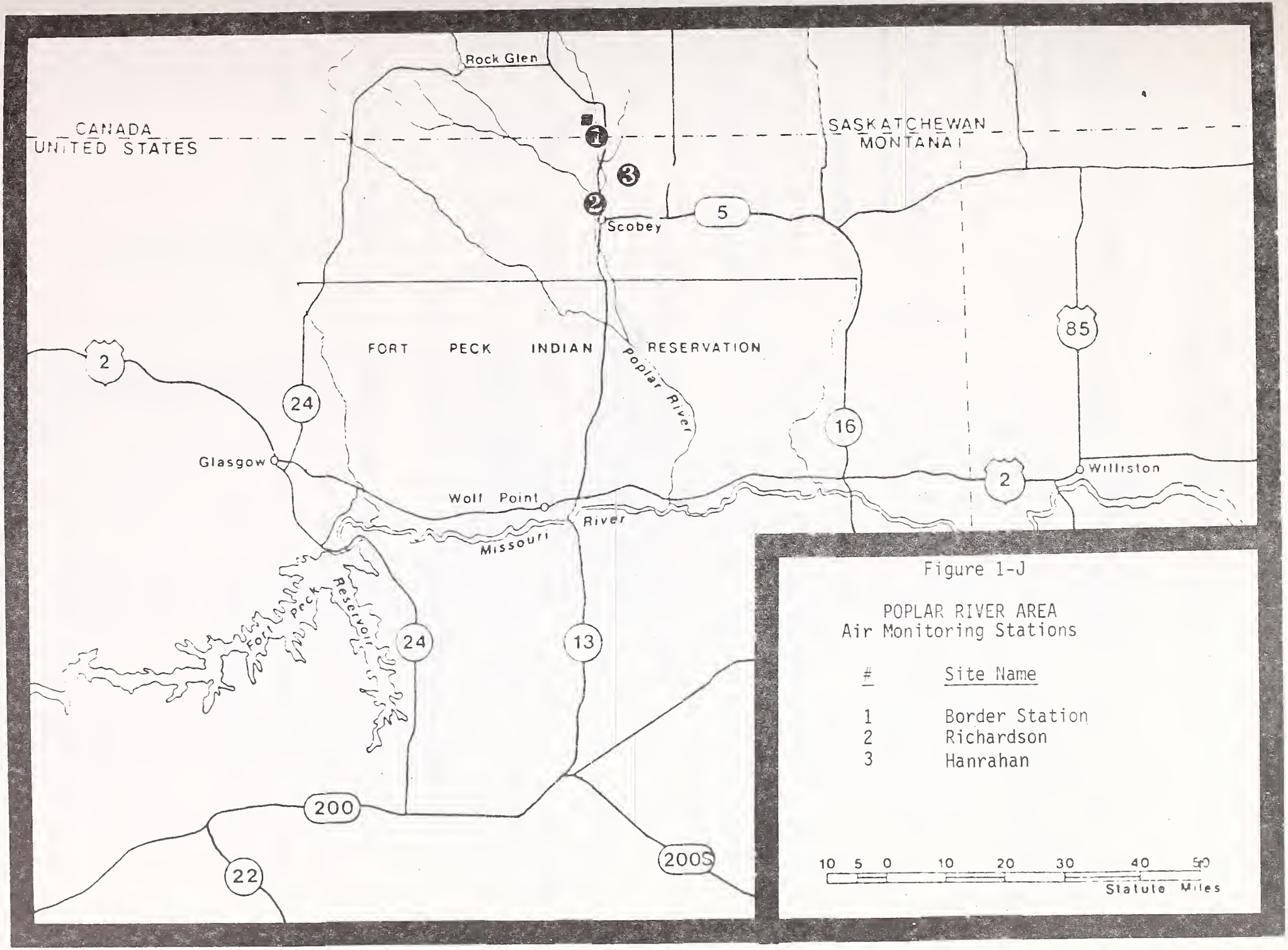


Figure 1-J

POPLAR RIVER AREA
Air Monitoring Stations

#	Site Name
1	Border Station
2	Richardson
3	Hanrahan

10 5 0 10 20 30 40 50
Statute Miles

Table J-II
Poplar River Area - TSP
Micrograms Per Cubic Meter

Site	1980 Geo. Mean	1980 1-High	1980 2-High	1981 Geo. Mean	1981 1-High	1981 2-High
Scobey - Border	17	116	115	28	1358	637
Scobey - Richardson	21	106	102	*34	452	82
Scobey - Hanrahan	*14	37	33	23	544	294

*Less than eight months of data

Table J-III summarizes respirable particulate from the Border site. This sampling is done with a dichotomous sampler which splits the particulate matter into two fractions: fine (less than 2.5 microns) and coarse (2.5 to 15 microns). Some RP readings were fairly high but not with enough consistency to create concern.

Table J-III
Poplar River Area - Respirable Particulates
Micrograms Per Cubic Meter
Size Classification - Microns

Site	Year	<2.5 Max	<2.5 Mean	2.5-15 Max	2.5-15 Mean	<15 Max	<15 Mean
Scobey-Border	80	8.2	3.5(8)	123.0	15.5(8)	127.8	19.9(8)
	81	106.6	9.4(12)	307.6	25.5(12)	414.2	33.6(12)

( ) - parentheses denotes number of sample months

Sulfate and nitrate analyses were performed on hi-vol filters using automated colorimetric methods. Values for these parameters are very low and consistent with what would be expected for background sites. Table J-IV summarizes this data for the three hi-vol sites.

Table J-IV
Poplar River Area - Sulfates and Nitrates
Micrograms Per Cubic Meter

Site		1980 Mean	1980 1-High	1980 2-High	1981 Mean	1981 1-High	1981 2-High
Scobey-Border	NO_3	0.7(12)	2.4	1.8	0.8(12)	3.5	2.9
	SO_4	3.5(12)	20.9	18.6	3.4(12)	20.4	18.4
Scobey - Richardson	NO_3	0.9(12)	3.7	2.7	1.1(6)	4.2	1.7
	SO_4	4.1(12)	13.9	10.5	4.2(6)	9.3	6.0
Scobey - Hanrahan	NO_3	0.7(3)	1.8	1.1	1.0(12)	3.9	3.0
	SO_4	5.9(3)	4.6	4.6	3.0(12)	15.2	7.6

( ) - parentheses denotes number of sample months.

Monitoring of sulfur dioxide with a continuous analyzer was started in October, 1979 at the Border and Hanrahan sites. Table J-V lists a summary of that data. Sulfur dioxide levels are practically non-existent, although a slight increase can be seen after the plant startup in October of 1980. An hourly maximum of 0.051 ppm was recorded in June of 1981 at the Hanrahan site.

Table J-V
Poplar River Area - Sulfur Dioxide
Parts Per Million

	Scobey Border - 1980		Scobey Border - 1981	
	Hourly Max	Monthly Mean	Hourly Max	Monthly Mean
Jan	.009	.001	.007	.001
Feb	.011	.001	.029	.002
Mar	.006	.002	.004	.001
Apr	.004	.001	.004	.000
May	.008	.001	.019	.002
Jun	.000	.000	.014	.001
Jul	.006	.000	.017	.001
Aug	.002	.000	.009	.003
Sep	.004	.000	.036	.003
Oct	.010	.001	.006	.001
Nov	.004	.001	.020	.002
Dec	.016	.002	.012	.002
Annual Mean:		.001		.002

Table J-V (continued)
Poplar River Area - Sulfur Dioxide
Parts Per Million

Hanrahan Site - 1981

	Hourly Max	Monthly Max
Jan	.005	.001
Feb	.007	.001
Mar	.031	.002
Apr	.009	.001
May	.003	.000
Jun	.051	.001
Jul		
Aug	.005	.001
Sep		
Oct	.015	.000
Nov	.010	.000
Dec	.007	.001
Annual Mean:		.001

Visibility in this area is very good. This is primarily due to the excellent ventilation provided by near constant winds and very few sources of fine particulate.

For a more comprehensive analysis of the data from this area, a copy of Background Air Quality Studies of the Poplar River Area of Northeastern Montana, 1978, can be obtained from state libraries or the Air Quality Bureau.

APPENDIX A

Glossary of Air Quality Terms

APPENDIX A

GLOSSARY OF AIR QUALITY TERMS

ABSORPTION
(Engineering) The process of dissolving a gas or one of a mixture of gases in a liquid
(Bio-medical) The taking up of fluids or other substances by the skin, mucous surfaces, or absorbent vessels

ACID MIST
A mist of fine aqueous droplets which contain dissolved acidic compounds, such as sulfuric acid.

ADIABATIC LAPSE RATE
The change of temperature with height of a parcel of dry air if it is lifted or lowered, with no loss or gain of heat.

ADSORPTION
The adhesion in an extremely thin layer of the molecules of gases or dissolved substances, or liquids, to the surfaces of bodies with which they are in contact.

AEROSOL
Suspended particulate matter consisting of smoke, dusts, and fumes which are either solid or droplets of liquids. Aerosol particles vary in size from well below one micron to approximately 100 microns in diameter.

AMBIENT AIR
That portion of the atmosphere, external to buildings, to which the general public has access.

AMBIENT AIR QUALITY
A physical and chemical measure of the concentration of various chemicals in the ambient atmosphere. The quality is usually determined over a specific time period.

ANTHRACITE
A type of a coal, hard, with high luster, which contains little volatile matter distinguishing it from bituminous coal.

AROMATIC
In organic chemistry, designating a large class of organic compounds which contain benzene rings. The simplest aromatic compound is benzene.

ASTM
ASTM (American Society for Testing Materials) is a voluntary organization of companies and individuals, established for the purpose of setting up standard methods of testing, so that different individuals can obtain comparable test results upon the same sample. ASTM standard test methods are available for almost all types of materials, including some air pollutants. An ASTM Apparatus is the specific apparatus designated by ASTM for a specific test.

ATMOSPHERIC PRESSURE (Also called barometric pressure)

The pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the "column" of air lying directly above the point in question. As with any gas, the pressure exerted by the atmosphere is ultimately explainable in terms of bombardment by gas molecules; it is independent of the orientation of the surface on which it acts.

Atmospheric pressure is one of the basic meteorological elements. It is measured by many varieties of barometer, and is expressed in several units systems. The most common unit used is the millibar (one millibar equals 1000 dynes per cm^2). Unique to the science of meteorology is the use of inches (or millimeters) of mercury; that is, the height of a column of mercury that exactly balances the weight of the column of atmosphere whose base coincides with that of the mercury column. Also employed are units of weight per area and units of force per area. A standard atmosphere has been defined in terms of equivalence to each of the above unit systems, and it is used as a unit itself.

ATTAINMENT AREA

A geographic area in which the quality of the air is better than federal air pollution standards. PSD requirements apply to attainment areas.

ATOMIZING SCRUBBER

A wet collector in which use is made of a liquid medium to increase the size of aerosol particles to facilitate its removal from a gas stream. In an atomizing scrubber, water is introduced at the throat of a venturi through which gas (containing aerosol particles) is moving at high velocity. Units of this type have a high pressure drop, and are used to get high removal efficiencies for particles of relatively small diameters (e.g., below 1.5 microns).

BACT - "Best Available Control Technology"

The term best available control technology means an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, or a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of each such pollutant. (Clean Air Act, Section 169(3))

BAGHOUSE

An enclosure containing many cloth bag filters. Dust laden air entering at the top or bottom of a bag is discharged through the cloth directly to the atmosphere while the solid particles are deposited inside the bag.

BITUMINOUS

A type of coal, soft, which yields considerable volatile matter when heated. Burning this type of coal in open fireplaces or household stoves has caused serious air pollution problems (London, formerly in Pittsburgh and Saint Louis) because of the lack of sufficient temperature above the firebed to burn the volatilized gases and tars (i.e. both gaseous and particulate emissions).

BRONCHITIS
Inflammation of the bronchial tubes (wind pipe), which includes the bronchi (s. bronchus) and the choncia (s. bronchium) and through which air passes to the lungs.

BULK DENSITY
The quotient of the total mass of a mixture (usually liquid plus solid or gas plus solid) divided by the total volume.

CARBON DIOXIDE (CO_2)
A colorless, odorless, incombustible gas, used to make carbonated beverages, dry ice, etc. It is a product of respiration, combustion, fermentation, decomposition and other natural processes, and is always present in the atmosphere.

CASCADE IMPACTOR
A device for separating dust particles from a moving air stream. In principle a dust particle collides or impacts on a solid surface and thus is collected while the air stream moves around the solid surface. An assembly of a series of such surfaces is called a cascade impactor.

CHROMATOGRAPHY
A technique used by chemists to cause the separation of small amounts of chemical compounds in order to determine their identity and quantity.

CIRCULATION PATTERN
The general geometric configuration of atmospheric circulation at a given time and region.

CLASS I AREA
Any area which is designated for the most stringent degree of protection from future degradation of air quality. The Clean Air Act designates as mandatory Class I areas each national park over 6,000 acres and each national wilderness area over 5,000 acres.

CLASS II AREA
Any area cleaner than federal air quality standards which is designated for a moderate degree of protection from future air quality degradation. Moderate increases in new pollution may be permitted in a Class II area.

CLASS III AREA
Any area cleaner than federal air quality standards which is designated for a lesser degree of protection from future air quality degradation. Significant increases in new pollution may be permitted in a Class III area.

CLEAN AIR ACT
A law enacted by Congress to protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population.

CRITERIA POLLUTANT
A pollutant for which EPA has established a national ambient air quality standard under Section 109 of the Clean Air Act. Present criteria pollutants are: carbon monoxide, hydrocarbons, lead, nitrogen dioxide, ozone, sulfur dioxide and total suspended particulate.

CLOTH FILTER
A cloth bag filter; see BAGHOUSE

COLLECTION EFFICIENCY
The ratio of the weight fraction of aerosol which is retained in the collector to that which entered the collector. Collection efficiency could be specified in terms of particle numbers or other physical characteristics for special cases.

COMBUSTION
The rapid reaction of carbon containing substances (or other oxygen demanding materials) with oxygen producing a rapid temperature increase and a flame.

COMBUSTION CHAMBER
That part of a furnace or incinerator in which burning takes place.

CONING
A name which describes the approximate shape of a smoke plume in a neutral atmosphere (see FANNING).

CONVECTION
(In meteorology) a mechanical process thermally produced involving the upward and downward transfer of a limited portion of the atmosphere.

CYCLONE COLLECTOR
A device for separating solid particles from gases or liquids. The carrier gas or liquid is made to move in a rapid spiralling motion (cyclonic) throwing the solids by centrifugal force to the walls of the collector.

DEPOSITION VELOCITY
The minimum velocity of a small particle suspended in a moving air stream that will give the particle sufficient momentum to carry it into a target (deposit the particle on a collecting surface). At lower velocities the particle will remain in the air stream and go around the target.

DEW POINT (or dew point temperature)
The temperature to which a given parcel of air must be cooled at constant pressure and constant water vapor content in order for saturation to occur.

DISPERSION
The action of mixing air containing a high concentration of pollutants arising from a pollutant source with the ambient air thereby reducing the ambient pollutant concentration.

DUST COLLECTORS
Any device used to remove particulate matter from exhaust streams

DUSTFALL
The amount of large particulate matter deposited per unit time per unit area of surface.

ELECTROLYTIC BATH
A container of liquid or molten materials through which an electric current is passed to cause chemical decomposition.

ELECTROSTATIC PRECIPITATOR
A device for collecting dispersed particles. Particle laden air is passed between two surfaces carrying a high electric potential and under the force of the electric field the particles are driven to a collecting electrode and precipitated.

EMPHYSEMA
The presence of air in the alveolar tissue of the lungs due to rupture of the alveoli. Progressive development of this condition leads to enlargement of the lungs and the chest cavity simultaneously with reduced capacity for breathing and efficiency of breathing.

FANNING
The characteristic appearance of a smoke plume emitted under extreme inversion conditions, where little vertical mixing of smoke in the atmosphere takes place (see CONING).

FLUE GASES
All the gases discharged from any stationary combustion process

FLUE GAS DESULFURIZATION
One of several processes by which sulfur dioxide is removed from the flue gas as a disposal solid, elemental sulfur or sulfuric acid.

FLUORIDE
The generic name of all simple chemical compounds containing fluorine, as sodium fluoride.

FLUORINE
A nonmetallic chemical element, a pale yellow, highly corrosive and toxic gas.

FLUOROSIS
Chronic poisoning by fluorides

FLY ASH
The non-combustible particles contained in flue gas.

FOSSIL FUELS
Oil, coal or natural gas

FREE LIFT
The actual lifting force of an inflated balloon, usually expressed in grams. The free lift plus the weight of the balloon and attached equipment is the total lift.

FUME
A fume is formed by sublimation of solid particles from the gaseous state. The term is frequently used to describe suspensions of very small (submicron) particles.

GASIFICATION
The process of converting solid or liquid fossil fuels to gaeous fuel, usually with the elimination of sulfur.

GRAVITY SETTLING

The application of gravitational force to cause solid particles to drop out of the air. Practically it is useful for removing only particles larger than 50 microns in size.

HALOGEN

Any of the five very active, nonmetallic chemical elements: fluorine, chlorine, bromine, iodine, and astatine.

HYDROCARBON

Any of the class of compounds consisting solely of hydrogen and carbon.

1. paraffins whose molecules contain the maximum possible of hydrogen.
2. aromatics, whose molecules contain benzene rings.
3. naphthenes, whose molecules are ring shaped.
4. olefins, whose molecules contain double bonds.

HYDROFLUORIC ACID

A water solution of hydrogen fluoride. In the gaseous state, hydrogen fluoride is colorless, corrosive, and poisonous.

HYDROGEN

The most simple chemical element and the lightest of all gases. It is found chiefly combined with oxygen to form water; also found in acids, bases, hydrocarbons, etc.

INCINCERATORS

Any device to burn solid and combustible liquid residues or wastes in order to reduce their bulk. The ash residue may be used for landfill or dumped at sea. Flue fed incinerators are those where the garbage or refuse is supplied to the combustion chamber through the same flue used for discharge of the products of combustion. A power generating or combination incinerator is one in which the heat from refuse combustion is used to generate steam. Primary air is usually supplied with the material being burned. Secondary air is usually supplied to complete combustion of incompletely burned gaseous fractions over the fuel bed. Tertiary air may be supplied to further improve combustion in a secondary chamber.

INCREMENTS

The amount of additional pollution, beyond already existing background levels, which may be allowed in a particular PSD area. The size of allowable increment varies with whether the area is Class I, Class II or Class III.

INVERSION

A meteorological condition in which the temperature of the atmosphere rises with increased elevation instead of falling; a negative temperature lapse rate.

INVERSION LAYER

A layer in the atmosphere through which the temperature remains constant or increases with altitude.

ISOKINETIC
Having the same speed and direction. When sampling gas streams for certain purposes it is important that the gas flow into the sampler be of the same speed and direction as the main gas stream. This is called isokinetic sampling.

LAER - Lowest Achievable Emission Rate
A requirement applying to proposed new or modified major stationary sources in nonattainment areas. LAER means the "rate of emissions which reflects
a. The most stringent emission limitation which is contained in the (SIP) of any state for such class or category of source.... or
b. the most stringent emission limitation which is achieved in practice..., whichever is more stringent.

LAPSE RATE
The change in an atmospheric variable, usually temperature, with height.

LIGNITE
A naturally occurring coal-like material often having a distinct woody texture.

MACROMETEOROLOGY
Large-scale weather events as opposed to local micrometeorological events.

MERCAPTAN
One of a class of sulfur-containing organic chemical compounds (R-SH), which have an extremely offensive odor.

METEOROLOGY
The science dealing with the atmosphere and its phenomena, particularly relating to weather.

METHANE
The first of the series of hydrocarbons (CH). It is a colorless, odorless, flammable gas and is the chief constituent of natural gas.

MICROMETEOROLOGY
The science of small-scale weather events.

MICRON (MU)
A metric unit of measure of length equal to one millionth of a meter and to one thousandth of a millimeter. This unit is often used for describing sizes of airborne particles and is commonly designated by the Greek letter u (mu).

MIXING HEIGHT (or mixing depth)
The thickness of the atmospheric layer, measured from the surface upward, through which pollutants are presumed to mix by virtue of convection caused by daytime heating at the surface. The designation of mixing height implies the existence of an inversion, in which case the mixing height is also the height of the inversion base.

NECROSIS
Gradual decay in trees or plants

NITROGEN OXIDES

Compounds of nitrogen including N_2O, NO, NO_2, NO_3, N_2O_3, N_2O_4, N_2O_5. Those most commonly encountered in the atmosphere are nitrous oxide (N_2O), a normal constituent of the air, and nitric oxide (NO) and nitrogen dioxide (NO_2) which are classified as pollutants.

NONATTAINMENT AREA

A geographic area in which the quality of the air is worse than federal air pollution standards. PSD requirements do not apply in nonattainment areas.

NSPS - New Source Performance Standards

EPA emission standards for certain categories of new or modifed air pollutant sources.

OXIDANT

Any chemical element or compound which will cause any other element to increase in positive valence in a chemical reaction. Less precisely, any chemical element or compound, e.g. NO_2, including oxygen which has the same effect as oxygen in a chemical reaction. In photochemical smog, the sum of all compounds detected by reaction with reducing agent, e.g., potassium iodide solution.

OZONE

A form of oxygen, O_3, having three atoms of oxygen to the molecule. It is found in the atmosphere in minute quantities and is a powerful oxidizing agent. It is a toxic constituent of photochemical smog.

PARAFFINS

A class of saturated hydrocarbons characterized by their chain-like molecular structure. See HYDROCARBON.

PARTICLES

Any solid matter emitted by a pollutant source. It is composed of settleable matter (which will settle as dust within a reasonable period of time) and suspended matter (which remains suspended in the atmosphere until washed out by precipitation, deposited by impaction, or some other process).

PARTICULATE MATTER

Finely divided solids or liquids. See AEROSOL.

PHOTOCHEMICAL SMOG

Air pollution resulting from light-induced reaction between certain organic materials and nitrogen dioxide.

PILOT BALLOON

A small balloon whose ascent is follwed by a theodolite in order to obtain data for the computation of the speed and direction of winds in the upper air.

PILOT-BALLOON OBSERVATION (Commonly pibal)
An observation method for winds aloft; that is, the determination of wind speeds and directions in the atmosphere above a station. This is done by reading the elevation and azimuth angles of a theodolite while visually tracking a pilot balloon.

The ascension rate of the balloon is approximately determined by careful inflation to a given total lift. After release from the ground, periodic readings (usually at one-minute intervals) of elevation and azimuth angles of the balloon are recorded. These data are transferred to a winds-aloft plotting board, and the wind speed and direction at selected levels are calculated by trigonometric methods.

PREVAILING WIND DIRECTION (or prevailing wind)
The wind direction most frequently observed during a given period. The periods most frequently used are the observational day, month, season and year.

PSD - Prevention of Significant Deterioration
A planning and management process under Sections 160 through 169 of the CAA for allocation and use of air resources.

RADIATION INVERSION
A type of atmospheric inversion occurring usually at night when the earth's surface loses heat by radiation, thus cooling the layer of air next to the ground. See INVERSION.

RESIDUAL FUEL OIL
The remainder after the more valuable petroleum gas, gasoline, lubricants, paraffin waxes and asphalt are removed from petroleum. This heavy oil is used as fuel and is graded number 4, 5, or 6, with the heavier grades bearing higher numbers. These grades are also cheaper and usually contain more sulfur. The amount of sulfur in the "RESID" depends on the feed stock (source of the crude oil) and the use of dehydrosulfurization processes.

RINGLEMANN CHART
A chart showing four numbered shades of gray as well as pure white and all black, used by visual comparison for estimating the density of smoke as it emerges from a stack. The matched comparison with the chart is referred to as a Ringlemann Number.

SCRUBBER
Any device in which an aerosol is removed from a gas stream by a liquid droplet.

SETTLING VELOCITY
The speed at which an object will move through its surroundings under the force of gravity.

SIP - State Implementation Plan
A state developed, federal approved plan for implementing and enforcing requirements of the CAA.

SMOG

A combination of smoke and fog, usually generated as a result of atmospheric contamination. London (England) type smog arises as a result of the combined presence of sulfur oxides and particulates in a humid environment. Los Angeles smog or photochemical smog occurs when sunlight generated reactions involving hydrocarbon, ozone and nitrogen oxide take place. The smog is most visible when high concentrations of water vapor occur in the atmosphere simultaneously but may appear as a bluish haze in a dry atmosphere.

SOLAR RADIATION

The total electromagnetic radiation emitted by the sun.

SOOT

Aggregated particles of unburned carbon produced by incomplete combustion. The soot may contain sufficient amounts of sulfur oxides or compounds to damage paint or enamel finishes.

SPRAY CHAMBER

The simplest type of gas scrubber. Gas is passed countercurrent to falling drops of liquid (usually water) from a bank of spray nozzles. A typical appliction is the removal of fly ash and cinders from flue gases.

STABLE

Pertaining to the atmosphere or an atmospheric layer in the condition of static stability, that is, an atmosphere whose temperature lapse rate and moisture distribution is such as to suppress vertical exchange of air.

STAGNATION

With respect to air pollution, the persistence of a given volume of stable air over a region, permitting an abnormal buildup of pollutants from sources within the region.

STATIC STABILITY (Also called hydrostatic stability, vertical stability, convective or convectional stability)

The state of the atmosphere when it is stable relative to vertical displacements. Such an atmosphere tends to remain stratified, in that any air that is displaced vertically is subjected to a buoyant force that tends to restore it to its original level.

Static stability is determined primarily by the temperature lapse rate; an inversion layer is an extreme example of a statically stable layer.

STOICHIOMETRIC

In the exact combining proportions of materials involved in a specific chemical reaction.

SUBSIDENCE INVERSION

An atmospheric inversion due to the downward motion or air, about a stationary high-pressure area with concomitant adiabatic temperature rise. Such an inversion is common to Southern California in the warm months of the year. See INVERSION.

SURFACE INVERSION (or ground inversion)

A temperature inversion based at the earth's surface; that is, an increase of temperature with height beginning at the ground level.

This condition is due primarily to greater loss of heat due to radiation at and near the surface than at levels above. Thus, surface inversions are common over land prior to sunrise and in winter over high-latitude continental interiors.

SYNERGISM

Cooperative action of discrete pollutants such that the total effect is greater than the sum of the two effects taken independently.

TEMPERATURE INVERSION

A layer in which temperature increases with altitude. The principal characteristic of an inversion layer is its marked static stability, so that very little turbulent exchange can occur within it. Strong wind shears often occur across inversion layers, and abrupt changes in concentrations of atmospheric particulates and atmospheric water vapor may be encountered on ascending through the inversion.

When, in meteorological literature and discussion an "inversion" is mentioned, a temperature inversion is usually meant.

THEODOLITE

An optical instrument which consists of a sighting telescope mounted so that it is free to rotate around horizontal and vertical axis and graduated scales so that the angles or rotation may be measured. The telescope is usually fitted with a right-angle prism so that the observer continues to look horizontally into the eyepiece, whatever the variation of the elevation angle. In meteorology, the theodolite is used principally to observe the motion of a pilot balloon.

TOTAL LIFT

The upward force produced by the gas in a balloon. It is equal to the sum of the free lift, the weight of the balloon, and the weight of auxiliary equipment carried by the balloon.

WET COLLECTORS

Dust collectors which operate by contacting the dust with a liquid (usually water). The class includes spray chambers and atomizing scrubbers.

WIND

Air in motion relative to the surface of the earth. Since vertical components of atmospheric motion are relatively small, especially near the surface of the earth, meteorologists use the term to denote almost exclusively the horizontal component. Vertical winds are always identified as such.

WIND ROSE

A diagram showing the wind direction and speed and their variations for a day, a month, or any other specified period of time, for a specific location and altitude.

WIND VANE

An instrument used to indicate wind direction.

APPENDIX B

Ambient Air Quality Standards

APPENDIX B

AMBIENT AIR QUALITY STANDARDS

In December, 1977, the Montana Board of Health and Environmental Sciences directed the Air Quality Bureau to propose an administrative rule containing new enforceable ambient air quality standards.

A set of standards had been on the books for ten years; however, they were considered as goals or guidelines rather than enforceable standards.

It was decided that before new standards were adopted there should be a thorough review to determine whether the old standards were still appropriate or whether scientific research completed since their adoption indicated different standards were necessary.

Subsequently, $147,000 was provided to hire a staff and consultants. This study was called the Montana Ambient Air Quality Standards Study (MAAQS).

As a result of this work a draft environmental impact statement was published in January, 1979; a final statement in February, 1980.

After several public meetings and experts' testimony, the Board of Health and Environmental Sciences passed a set of "enforceable" standards in August, 1980. Table AP-B-I lists the Montana and national ambient air quality standards. Additional information about the standards is provided on the following page.

Table AP-B-I

MONTANA AND NATIONAL AIR QUALITY STANDARDS

POLLUTANT	MONTANA STANDARD	FEDERAL PRIMARY STANDARD	FEDERAL SECONDARY STANDARD
Total Suspended Particulates	75 ug/m^3 annual average 200 ug/m^3 24-hr average*	75 ug/m^3 annual geometric mean 260 ug/m^3 24-hr average*	60 ug/m^3 annual geometric mean 150 ug/m^3 24-hr average*
Sulfur Dioxide	0.02 ppm annual average 0.10 ppm 24-hr average* 0.50 ppm 1-hr average**	0.03 ppm annual average 0.14 ppm 24-hr average*	0.5 ppm 3-24 average*
Carbon Monoxide	9 ppm 8-hr average* 23 ppm hourly average*	9 ppm 8-hr average* 35 ppm 1-hr average*	9 ppm 8-hr average*
Nitrogen Dioxide	0.05 ppm annual average	0.05 ppm annual average	0.05 ppm annual average
Photochemical Oxidants (ozone)	0.10 hourly average*	0.12 ppm 1-hour average*	0.12 ppm 1-hr average*
Lead	1.5 ug/m^3 90-day average	1.5 ug/m^3 calendar quarter average	None
Foliar Fluoride	35 ug/g grazing season 50 ug/g monthly average	None	None
Hydrogen Sulfide	0.05 ppm hourly average*	None	None
Settled Particulate (Dustfall)	10 gm/m^2 30-day average	None	None
Visibility	Particle scattering co-efficient of 3 x 10^{-5} per meter annual average***	None	None

*Not to be exceeded more than once per year
ug/m^3 micrograms pollutant per cubic meter of sampled air
ppm parts pollutant per million parts of sampled air
**Not to be exceeded more than 18 times per year
***Applies to PSD Class I areas

Air quality standards have been developed at the National level for six classes of air pollutants and at the State level for nine pollutants plus visibility. Below is a synopsis of each of the pollutants.

Sulfur Dioxide - Sulfur dioxide originates from the burning of fossil fuels such as coal or oil. The pollutant is known for causing significant loss in crop yield, rusting metals, reducing visibility and irritation of eyes, nose, throat and lungs.

Particulate Matter - Particulate matter may originate from natural sources such as forest fires and erosion, or result from automobiles, industrial processes, unpaved roads, agriculture, construction and other human activities. These tiny particles can damage paint, reduce visibility, and carry poisonous chemicals into the lungs causing cellular damage.

Carbon Monoxide - Carbon monoxide is a by-product of the incomplete combustion of organic fuels. The most notorious source is the automobile. This odorless gas can, in small amounts, cause headaches, dizziness, fatigue and slow reactions. It can be especially dangerous for people with heart disease. In larger amounts it can cause death.

Photochemical Oxidants (Ozone) - Photochemical oxidants are produced in the atmosphere when hydrocarbons and nitrogen oxides, combustion wastes from gasoline and other fuels, are exposed to sunlight. Oxidants irritate the eyes, nose, and throat, make breathing difficult, reduce visibility, and damage vegetation.

Hydrocarbons - Hydrocarbons are the unburned chemicals from the combustion or evaporation of organic compounds. Automobile exhaust and uncontained storage of petroleum products are common sources of hydrocarbons. They have been known to cause vegetative damage and contribute to photochemical oxidants.

Nitrogen Oxides - Nitrogen oxides usually originate in high-temperature combustion processes including diesel engines. It is not only a component of photochemical oxidants, but causes an unpleasant smelling brown haze, and is irritating to the nose and throat.

Fluoride - Sources of fluorides include the aluminum, glass, brick, fertilizer and, to a smaller degree, the oil industries. In excessive amounts, fluorides can cause bone deformities and damage vegetation.

Lead - Lead in the air is generally the result of automobiles and ore smelters. Physical problems of high lead content include gastrointestinal cramps, central nervous system effects, kidney disease and anemia.

Hydrogen Sulfide - Sources of hydrogen sulfide, the "rotten egg" pollutant include sewage treatment, kraft pulp and oil industries. The pollutant can damage paint, tarnish copper, injure vegetation, produce a losss of the sense of smell, cause severe respiratory tract irritation and in large doses, cause death.

APPENDIX C

Attainment Nonattainment Designations

APPENDIX C

ATTAINMENT-NONATTAINMENT DESIGNATIONS

This appendix briefly summarizes the designation of attainment/non-attainment areas for Montana. For the purposes of this report, we have copied portions of a January 1978 non-attainment designation document. The copied portions include the general narrative and pollutant attainment status. Specific maps of the area have not been included. For a more complete report, the user can request a copy from the Air Quality Bureau.

Since the original non-attainment designation document was submitted to EPA, additional ambient monitoring data precipitated two classification changes. The non-attainment status for Butte particulates was changed during 1978 from non-attainment of secondary standards to non-attainment of primary standards. In addition, a portion of Great Falls along 10th Avenue South was designated non-attainment for carbon monoxide in 1979. The reader should keep these changes in mind when reading the original document.

I. INTRODUCTION

The 1977 Clean Air Act Amendments, enacted by Congress August 7, 1977, contained many new and expanded requirements regarding the control of air pollution. This report attempts to explain just one requirement contained in the amendments, but a very significant requirement. It is significant not so much in itself, but more in subsequent actions that follow. Section 107(d)(1) of the 1977 amendments requires the states to submit to EPA "...a list, together with a summary of the available information, identifying those air quality control regions, or portions thereof..." classifying these areas according to whether they meet the national ambient air quality standards (NAAQS).

II. CLASSIFICATIONS AND DATA

Standards and Classification Requirements

Five classifications are possible - three for particulate matter (PM) and sulfur dioxide (SO_2) and two for pollutants other than particulate matter or sulfur dioxide. The five classifications are summarized below.

A) Do not meet a national primary ambient air quality standard for oxidants, carbon monoxide (CO) or nitrogen dioxide (NO_2).

B) Do not meet, or in the judgment of the State will not attain or maintain in the time required by the applicable SIP, any national primary ambient air quality standard for sulfur dioxide or particulate matter.

C) Do not meet a national secondary ambient air quality standard.

D) Cannot be classified as (B) or (C), on the basis of available information, for PM or SO_2.

E) Have ambient air quality levels better than any national primary or secondary ambient air quality standard for oxidants, CO, or NO_2, or for which there is insufficient data to be classified (A) or (C).

Areas designated as A, B or C are referred to as non-attainment areas, and areas designated as D or E are referred to as attainment (or unclassified) areas.

Table 1 shows the NAAQS against which air quality data is evaluated to determine the status of areas for the classifications.

These standards apply to ambient air, or the outdoor air to which the public has access. The standard for hydrocarbons, while still legally a standard, is not being used. The primary standards are those levels which the EPA Administrator judges necessary to protect the public health with an adequate margin of safety. The secondary standards are designed to protect the public welfare from any known or anticipated adverse effects from a pollutant, in the Administrator's judgment.

Table 1

National Ambient Air Quality Standards

Pollutant	Primary Standard	Secondary
Total Suspended Particulate Matter	75 ug/m^3, annual geometric mean, 260 ug/m^3, 24-hour average*	60 ug/m^3, annual geometric mean, 150 ug/m^3, 24-hour average*
Sulfur Dioxide	80 ug/m^3 (0.07 ppm) annual arithmetic mean, 365 ug/m^3 (0.14 ppm) 24-hour average*	1300 ug/m^3 (0.5 ppm) 3-hour average*
Carbon Monoxide	9 ppm, 8-hour average* 35 ppm, 1-hour average*	Same
Nitrogen Dioxide	0.05 ppm, annual average	Same
Non-Methane Hydrocarbons	0.24 ppm, 6-9 a.m. average*	Same
Photochemical Oxidants	0.08 ppm, 1-hour average*	Same

*Not to be exceeded more than once per year.

Air Quality Data

The AQB has used, whenever possible, the last four consecutive quarters of air quality data to propose the designations. The 1977 CAAA require the classifications to be made as of the date of enactment which is August 7, 1977. A certain amount of judgment is required throughout this process. Choosing to use data through September, 1977, allows the designations to be made on the basis of the most current data available. Other choices were possible, such as the most recent four quarters ending and including June, 1977, or calendar year 1976, or data collected through July, 1977. The choice of September, 1977, provides very current data and required no consideration of emission reductions that older data might not reflect. The choice also provides a better quality of data than something older, as the data collecting techniques and quality assurance procedures are constantly improving. Also, rainfall in 1976 was extremely low, thus increasing fugitive dust problems from unpaved roads and windblown soil over a more normal year. Appendices A and B to this report contain a summary of the data used for the designations.

The AQB employed two ozone continuous monitors to propose the classification for oxidants. The federal reference method for oxidants measures ozone as it is considered representative of the total oxidant problem.

Data from two continuous NOx monitors were used for the NO_2 proposals. A third monitor has not generated sufficient data from which to propose a classification for the area.

Enough carbon monoxide data have been collected in three areas to propose classifications. In two other areas, insufficient data are available. CO concentrations are determined through use of continuous monitors.

Sulfur dioxide data are available from eleven continuous monitors and several SO_2 bubblers (reference method). All bubbler data in current network show attainment. These bubblers are located in eastern Montana and have been established primarily as background stations. The continuous analyzers are primarily located to monitor the effects from point sources. Data from source-owned monitors have also been used in preparing the designation proposals.

Suspended particulate data are generated from the hi-volume sampler filter, which is the reference method. The data from some 50 stations throughout the state were employed to prepare the proposals for TSP designations.

III. DESIGNATION PROPOSALS

The designation lists include a brief narrative for each of the areas proposed as non-attainment areas, and generally a statement of the values which resulted in the non-attainment classification. The following descriptions of attainment status are those submitted to EPA on January 6, 1978.

ATTAINMENT STATUS - OXIDANTS

The Department is proposing the entire state be unclassified for oxidants. The Colstrip station produced only 112 days data out of 304 days possible in 1977, and the 1976 data are of questionable validity. The Billings site has produced good data, and shows attainment. Also, the data from the two sites collected to date seem to be somewhat contradictory, thus the proposed unclassified status.

ATTAINMENT STATUS - NOx

	Designation		
Designated Area	107(d)(1)(A) Non-Attainment	107(d)(1)(E) Unclassified	107(d)(1)(E) Attainment
Billings, MT, Area			*
Colstrip, MT			*
Butte, MT		*	
Rest of State		*	

Summary of Documentation

The Billings site is located in a high traffic area of the Billings urban area, and reflects a "worst case" situation for traffic-related NOx. The data show no violations of the NOx standard (1976 annual average - 0.034 ppm; 1977 annual average - 0.029 ppm). Data validity is questionable but probably within 25%. Even if the data is 25% low, there would be no violation.

Data from the Colstrip site show no violations (annual average - 0.029 ppm) and the data are valid. NOx sources are coal-fired power plants and modeling shows no violations.

Data taken in Butte are inconclusive as only two months data have been collected. No data have been obtained for other areas of the state, and therefore the rest of the state is unclassified.

ATTAINMENT STATUS - CO

Designated Area	Designation 107(d)(1)(A) Non-Attainment	107(d)(1)(E) Unclassified	107(d)(1)(E) Attainment
Billings Downtown Area	*		
Butte Area		*	
Colstrip Area		*	
Great Falls		*	
Missoula Area	*		

The Billings area is proposed to be designated non-attainment based on violations of the CO standard at 27th and Montana site. The boundaries in Figure 1 are based on modeling done by PEDCo for the AQMA analysis and are designed to include only that area where violations are predicted to be occurring now.

The Butte, Colstrip and Great Falls areas are proposed as unclassified as the CO monitors have not generated sufficient data to make a determination of attainment/non-attainment.

The Missoula area, Figure 2, has been designated non-attainment with less than one year's data. The data, however, show 55 8-hour averages above 9 ppm, with a maximum 8-hour average of 13.87 ppm. Boundaries have been established using the major arterials including those areas of current traffic volumes which cause violations. The designated CO area is the same as the designated area for TSP primary standard non-attainment.

A lack of data for other areas of the state requires that all areas not specifically listed be unclassified.

ATTAINMENT STATUS - SO_2

Designated Area	Designation		
	Non-Attainment		
	107(d)(1)(B) Primary	107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
Laurel Area	*		
Anaconda Area	*		
East Helena Area	*		
Billings			*
Colstrip Area			*
Rest of State			*

Sulfur dioxide data are valid and show violations at various monitoring stations. Boundaries of non-attainment areas were determined from data and modeling.

The maps attached show the extent of the non-attainment areas above.

The Billings area is proposed as unclassified. SO_2 data in downtown Billings indicate attainment in that general area, but modeling predicts violations near major industrial sources for which no sampling data are available.

The East Helena area designation is based on data showing primary standard violations (e.g., 24-hour average = 0.26 ppm) and modeling which predicts the violations to occur as far as 0.67 km from the smelter. The boundaries are shown in Figure 3.

The Anaconda area designation is based on extensive sampling showing numerous violations of the 24-hour primary standard. Boundaries were established from the monitoring data and are shown on Figure 4.

The Laurel area designation derives from sampling showing 24-hour violations (max. 24-hour = 0.38 ppm) and modeling shows the violations to extend 2.0 km from the refinery as shown on Figure 5.

ATTAINMENT STATUS - TSP

Designated Area	Designation		
	Non-Attainment		
	107(d)(1)(B) Primary	107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
Decker			*
Hardin			*
Billings Downtown		*	
Billings Area			*(1)
Great Falls CBD		*	
Great Falls Area			*(2)
Butte Area	*		
Anaconda			*(1)
Philipsburg			*(1)
East Helena		*	
Three Forks			*(1)(2)
Miles City			*
Ekalaka			*(2)
Fort Peck			*
Lame Deer			*
Scobey			*
Glendive			*
Colstrip	*		
Broadus			*(1)
Lindsay			*(1)
Poplar			*
Columbia Falls	*		
Kalispell			*(1)
Libby			*
Troy			*
Missoula Area	*	*	

(1) Violation of standard due to fugitive dust from non-industrial sources - unpaved roads, etc.
(2) Insufficient data from which to classify the area.

Four areas are listed as secondary standard non-attainment. Maps are attached showing the proposed area boundaries.

The Billings downtown area is marginally above the standards (second high 24-hour 151, annual mean 60.6). The TSP problem stems from vehicle activity but the TSP will be contaminated and should not be considered fugitive dust. The proposed boundary is the Billings Downtown redevelopment area, as indicated on the map (Figure 6). The area includes the area predicted by modeling to be exceeding TSP standards.

A situation similar to Billings is found in Great Falls. The annual mean is 59.8 ug/m^3, with nine readings above 150 ug/m^3 and a maximum of 869 ug/m^3. The proposed boundary is the Great Falls CBD, shown in Figure 7.

**The Butte area exceeds both secondary standards significantly with an annual mean of 72.9 ug/m^3 and a second high of 226 ug/m^3. The boundary shown in Figure 8 is established by air quality modeling and does not follow any established area.

The East Helena area (Figure 9) is a localized problem which is proposed for designation because of the nearness of an industrial slag dump and contaminated soil.

Three areas are proposed to be designated as non-attainment for primary standard. The three areas are Colstrip, Columbia Falls and Missoula, and maps are attached depicting the boundaries.

The Colstrip area designation is based on company data showing significant violations of both the annual standard (annual mean 107 ug/m^3) and 24-hour standard (high value = 428, second high value = 379). The state station in the area does not show violations but these data do not represent the mining activity as the sampler is on top of a hill several hundred feet above the mining. This site was chosen to reflect power plant emissions, rather than low-level sources. Area boundaries include the mines and surrounding areas as shown in Figure 10.

The Columbia Falls site shows an annual mean of 68.4 ug/m^3 and second high of 271 ug/m^3. While a substantial portion of the problem probably stems from fugitive dust, the presence of several industrial sources in the area necessitates the non-attainment designation. The proposed boundary is the city limits of Columbia Falls as per Figure 11.

The Missoula area is proposed for designation, based on an annual mean of 77.4 ug/m^3 and six days above the 24-hour standard. Proposed boundaries are based on modeling performed for AQMA analysis and include all areas exceeding the primary standard. The area is also proposed for designation as non-attainment for the secondary standard. The boundaries are consistent with the AQMA analysis for predicted violations and are shown on Figure 12, primary, and Figure 13, secondary.

The remainder of the sites that show violations are due to fugitive dust as defined in the EPA policy paper, or have insufficient data on which to make a decision.

**Butte area, originally proposed non-attainment of the secondary TSP standard, was designated non-attainment of the primary standard by the EPA after the last quarter of the year's data was included. The annual average was greater than 75 ug/m^3

IV. IMPACTS OF DESIGNATIONS

The 1977 CAAA require that all areas of the state be classified. As previously discussed, there are, in effect, only two classifications - attainment (which includes unclassified) and non-attainment. If an area is designated as non-attainment, the implementation plan is required to include the non-attainment provision as specified in Part D of the Act (42 USC 7501 et seq). If an area is designated as attainment, the applicable SIP is to include the Prevention of Significant Deterioration (PSD) requirements of Part C (42 USC 7470 et seq).

Non-Attainment Areas

The requirements for a non-attainment plan depend on the pollutant for which the area is designated. For TSP or SO_2, the plan requirements are primarily directed at point sources; for CO, NO_2, or oxidants, the requirements are directed at mobile sources (motor vehicles).

Prior to promulgation of a revised plan, all major emitting facilities (emissions of more than 100 tons per year) are subject to EPA's "offset" policy. This policy requires that before any new facility can locate in an area, total emissions, including the new source, be sufficiently less than total emissions allowed without the new source to constitute reasonable progress toward attaining the standard. This means that existing sources must reduce emissions in order that the new source be permitted. There are provisions for waiver of the offset requirement providing the state has a permit program which will accomplish the same result; i.e., less total emissions in the area.

After July 1, 1979, the full requirements of a non-attainment plan must be in force. These include the application of all reasonably available control measures as expeditiously as practicable, annual incremental reduction in emissions, a comprehensive accurate current emission inventory, public, local government and State legislative involvement, and a restrictive permit program as specified in Section 173 of the Act. This permit program shall provide for annual incremental reductions in emissions, that new or modified sources comply with emission limitations which are the most stringent contained in any SIP or actually achieved in practice, whichever is lower, and that all sources under the control of the owner of the new or modified source are in compliance or on a schedule for compliance with applicable emission limitations.

This non-attainment plan is to achieve the primary NAAQS by December 31, 1982. For TSP and SO_2, no extensions are possible. For CO and/or oxidants, however, it is possible for EPA to grant an extension of this date to December 31, 1987. This extension can be granted if, despite the application of all reasonably available measures, attainment for these pollutants is not possible by 1982. This demonstration must be made before the date on which the plan is to be submitted (January 1, 1979).

If such a demonstration is made, the plan must contain three additional elements. It must include a program for analysis, for proposed new major sources, of alternatives regarding location, sizes, production processes and control techniques to demonstrate that "benefits of the proposed source significantly outweigh the environmental and social costs..." The plan must include a schedule for implementation of a vehicle emission control inspection and maintenance program, and identify the measures necessary to attain the standard by December 31, 1987.

A designation of a non-attainment area for CO or oxidants brings into play some other sections of the Act, most notably Sections 174 and 175. Congress has indicated a desire that local governments be responsible for implementation planning whenever possible, as stated in Section 174(a), as follows:

"Within six months after the enactment of the Clean Air Act Amendments of 1977, ...the State and elected officials of affected local governments shall jointly determine which elements of a revised implementation plan will be planned for and implemented or enforced by the State and which such elements will be planned for and implemented or enforced by local governments or regional agencies, or any combination of local governments, regional agencies, or the State. Where possible within the time required..., the implementation plan required by this part shall be prepared by an organization of elected officials of local governments.... Where such an organization has not been designated by agreement within six months after the enactment of the Clean Air Act Amendments of 1977, the Governor..., after consultation with elected officials of local governments, ... shall designate an organization of elected officials of local governments in the affected area or a State agency to prepare such plan."

Section 175 of the Act authorizes full federal funding for the first two years of plan development. Section 325 authorizes the appropriation of $75,000,000 for these purposes, but no appropriation was made. The money actually available to local governments for this may be minimal.

Congress has also mandated certain economic sanctions (Section 176). For example, the Secretary of Transportation is not to approve any projects, nor award any grants, for projects in a non-attainment area where transportation control measures are necessary for attainment if the state by July 1, 1979 (July 1, 1982, if extension obtained) has not submitted a suitable implementation plan. Safety, mass transit, and transportation improvement projects can be approved if air quality improvement-related.

Attainment Areas

If an area falls into the attainment or unclassified categories, the SIP must then contain the requirements of Part C, Prevention of Significant Deterioration, Sections 160-169. This portion of the Act sets limits for how much deterioration in air quality in an area will be considered significant. Congress essentially followed EPA's regulatory scheme of 1975, and made it law.

V. SUMMARY

Designation of an area, or lack of data, results in application of provisions of the 1977 CAAA having far-reaching and rather long-term effects. The non-attainment plans will require stricter permit standards and restrictive emission limits for both new and existing sources (offset), increased local government involvement, and potential economic sanctions for transportation related projects. The PSD provisions mandate an extensive (and expensive) pre-construction review, restrictive emission limits, additional monitoring requirements, and the realization of means of limiting growth using air quality considerations.

APPENDIX D

Summary of the Montana Air Pollution Study

APPENDIX D

SUMMARY OF THE MONTANA AIR POLLUTION STUDY

by Stephen Medvec

Introduction

A major four-year study by the Air Quality Bureau of the State Department of Health and Environmental Sciences of the effects of air pollution on human health in several of Montana's urban areas ended in June 1981. The Montana Air Pollution Study (MAPS), which was funded initially by the 1977 Montana Legislature for two years, and then extended by the 1979 session for an additional biennium, has cost $1.5 million. Fourteen interim reports have been published, and the project's final report was issued in June.

The 1977 Montana Legislature requested that air pollution-health effects studies be implemented in the cities of Anaconda, Billings, Butte, and Missoula, as well as in the towns of Columbia Falls, Colstrip, East Helena and Hardin. Bozeman and Great Falls were added during the initial study design to provide data from relatively unpolluted areas for comparison purposes. The study areas are located for the most part in mountain valleys or river canyons, where prolonged periods of air stagnation are common during the fall and winter.

The following studies were performed during the project: lung (pulmonary) function testing of school children and persons with respiratory diseases; screening for the presence of possible carcinogenic substances in the air and in children's urine in the Butte-Anaconda area; and a mortality study to determine numbers of deaths possibly related to air pollution in three counties during the period 1970-75.

Results

Pulmonary Function Testing

Results of comparative pulmonary function tests conducted in Anaconda, Billings, Butte, Great Falls and Missoula during the 1978-79 school year showed that Great Falls children, who were exposed to the least urban air pollution

levels, had the best pulmonary performance. Children from Missoula, with the highest particulate levels, and Anaconda, with the highest sulfur dioxide levels, had the worst pulmonary performance. Billings and Butte children were found to have readings between the two extremes. The study also revealed that in most cases females reacted more adversely to air pollution than males.

An analysis of pulmonary function measurements among Missoula children during the 1978-79 and 1979-80 school years showed consistently that as particulate levels in the air increased, pulmonary performance decreased. No significant decrease in the children's pulmonary ability was demonstrated following exposure to extremely high levels of volcanic ash in a separate analysis of data collected one week after the eruption of Mount St. Helens on May 18, 1980.

In 1978-79 an 18-month study of 84 adults with chronic obstructive pulmonary disease (COPD) was conducted. Results also showed decreasing pulmonary performance, as well as notable increases in coughing, wheezing and shortness of breath, with increasing air pollution levels.

Carcinogenic Screening in Butte-Anaconda

Measurement of the mutagenic potential of substances has become a standard procedure throughout the world to assess the carcinogenicity of substances, i.e., their potential for causing cancer. The Ames test predicts whether a substance will be carcinogenic on the basis of its mutagenicity to certain strains of bacteria. The MAPS project adopted this specific methodology to assess cancer risk in the Butte-Anaconda area.

In 1978-79, urine testing was conducted at three elementary schools in Anaconda and Butte, where lung cancer rates are low. Eleven Butte children, out of 80 sampled, had mutagen levels considered to be signficantly elevated. No Anaconda children reached these levels, and the levels of mutagen among Bozeman

children were not significant. The Butte children with elevated mutagen levels lived relatively near Front Street, a major east-west thoroughfare running parallel to the railroad tracks. The different mutagen levels between Anaconda and Butte test groups support the existing assumption that the two communities differ in distribution of carcinoma types and risk patterns between men and women.

Mortality Study in Three Counties

A 1974 review of Montana's vital statistics revealed that some counties had abnormally high death rates from asthma, chronic bronchitis, emphysema, cerebrovascular disease, and lung cancer, especially within the 40-65 age group. After an analysis of the data had been completed, Deer Lodge, Lake and Silver Bow Counties were selected for a more detailed investigation of possible causes for the high death rates. Although strong suspicion remains that exposure to ambient air pollution may have contributed to high death rates among residents of the three counties from lung cancer, respiratory diseases and cerebrovascular disease, it cannot be proven conclusively because of the variable of undocumented smoking habits. There may be a synergisitic effect from air pollution exposure and smoking.

Conclusion

Prior to undertaking the study pollution researchers, such as Drs. Benjamin Ferris of Harvard University and Ian Higgins of the University of Michigan were of the opinion that a correlation between increased air pollution and decreased lung performance could not be demonstrated at air pollution levels found in Montana.

MAPS, however, has confirmed the hypothesis that increased air pollution levels cause a decrease in lung functioning.

APPENDIX E

List of MAPS Technical Reports

APPENDIX E

List of MAPS Technical Reports

Health Effects

1. Johnson, K; Schwaller, R; Wing, B. et al. Pulmonary Function Testing of Patients with Chronic Obstructive Pulmonary Disease (September 1979).

2. Johnson, K.; Gideon, R.; Loftsgaarden, D.; Wing, B. et al. Pulmonary Function Testing of Elementary School Children (October 1979).

3. Johnson, K.; Gideon, R.; Loftsgaarden, D.; Medvec, S.; Simms, M. et al. Relationship Between Human Health and Inhalable Particulates (October 1980).

4. Warren, G.; Rogers, S.; and Medvec, S. Mutagen Screening in an Isolated High Lung Cancer Mortality Area of Montana (June 1979).

Air Quality

1. Gelhaus, J., Air Quality Data Summaries for Anaconda-Butte, Billings, Missoula, and Columbia Falls/Hardin/East Helena/Colstrip (February 1981).

2. Robbins, H.; Driscoll, P.; Myren, B. et al. Air Monitoring Instrumentation (October 1979).

Meteorology/Modeling

1. Gelhaus, J. et al. Meteorological Summary - First Year (July 1979).

2. Gelhaus, J. and Harner, S. Deer Lodge Valley Dispersion Study (July 1979).

3. Gelhaus, J. Meteorological Summary - Billings (February 1981).

4. Gelhaus, J., Machler, M., and Stewart, T. Montana Air Resources Modeling System (August 1979).

5. Middlemist, T.; Robbins, H; and Zimmerman, L. Missoula Valley Dispersion Study (September 1980).

6. Nelson, B.; Machler, M; and Robbins, H. Deer Lodge Valley Dispersion Study (October, 1980)

Emission Inventory

1. Bohn, R.; Cowherd, C.; Keller, R; and Raisch, R. Update and Improvement of the Emission Inventory for MAPS Study Areas (November 1979).

2. Raisch, R.; Williams, G.; Bohn, R.; and Cowherd, C. A Study of the Feasibility of Performing an Inventory of Historical Emissions at Butte and Anaconda, Montana (November 1979).

Systems Design

1. Lynn, D. et al. Computer Information System Development (November 1979).

APPENDIX F

List of Air Quality Reports

APPENDIX F

LIST OF AIR QUALITY REPORTS

Maughan, D.; Sternberg, S. A Network Review of Montana's Ambient Air Monitoring (April, 1979).

Machler, M.; Robbins, H. 1980 Network Review (October, 1980).

Raisch, R.; Robbins, H. 1981 Network Review (November, 1981)

McAllister, D.; Ruby, M.; Vichorek, D.; Crowley, F. Final Environmental Impact Study, Montana Ambient Air Quality Standards Study (February, 1980).

Gelhaus, J.; Machler, M.; Schwartz, S.; Roach, M. Background Air Quality Studies of the Poplar River Area of Northeastern Montana, 1978 (August, 1979).

Gelhaus, J.; Machler, M. Meteorological Study, Columbia Falls, Montana (March, 1979).

Robbins, H., et al. Montana Quality Assurance Manual (December, 1980).

Coefield, J. et al. Flathead River Basin Environmental Impact Study - Interim Annual Report for July 1979 through September 1980 (June 1980).

Erickson, R.; Tomlinson, W.; Steffel, R.; Baxter, T. Survey of Residential Wood Use in Helena, Bozeman, Great Falls, and Kalispell, Montana (June, 1981).

State of Montana Air Quality Rules (August 1980)

Clean Air Act of Montana (July 1979)

APPENDIX G

Point Source Emission Estimates

APPENDIX G

POINT SOURCE EMISSION ESTIMATES

The following two tables list emission estimates from various industrial sources in the state. Table AP-G-I lists sulfur dioxide emissions; Table AP-G-II lists particulates.

Table AP-G-I

POINT SOURCE SULFUR DIOXIDE EMISSION ESTIMATES FOR 1980

Source	SO_2 Tons/Yr	County	City
Exxon Co., USA	10735	Yellowstone	Billings
Farmers' Union CENEX	10380	Yellowstone	Laurel
Montana Power Co. (Corette)	9811	Yellowstone	Billings
Continental Oil Co.	3051	Yellowstone	Billings
Montana Sulfur	2136	Yellowstone	Billings
Great Western Sugar	711	Yellowstone	Billings
Westmoreland Resources	* 57	Big Horn	Hardin
East Decker Coal	* 46	Big Horn	Decker
West Decker Coal	* 46	Big Horn	Decker
Spring Creek Coal	* 17	Big Horn	Hardin
Philips Petroleum	1172	Cascade	Great Falls
Rainbow Resources	200	Glacier	Browning
WESTCO	12	Glacier	Cut Bank
Anaconda Co. Smelter	126642	Deer Lodge	Anaconda
ASARCO	28740	Lewis & Clark	East Helena
Ideal Basic Industries	130	Gallatin	Trident
Anaconda Co. Butte Operations	* 117	Silver Bow	Butte
Kaiser Cement	44	Jefferson	Montana City
Oil and gas flaring	210000	Williston Basin**	
Montana Dakota Utilities	2192	Richland	Sidney
Shell Oil, gas plant	1278	Richland	Sidney
Perry Petrolane, gas plant	867	Richland	Sidney
Valley County Ind. Park	174	Valley	Glasgow
American Colloid	63	Phillips	Malta
KENCO	55	Roosevelt	Wolf Point
Western Energy Coal	* 46	Rosebud	Colstrip
Peabody Coal	* 17	Rosebud	Colstrip
Anaconda Co. Aluminum	2646	Flathead	Columbia Falls
Champion Int., Packaging Div.	541	Missoula	Frenchtown
W. R. Grace	167	Lincoln	Libby
Burlington Northern tie plant	42	Sanders	Paradise
Stoltz Land and Lumber	37	Ravalli	Darby

*Includes tailpipe emissions from diesel powered vehicles.
**Estimated emissions for oil field gas flaring in the Williston Basin.

Table AP-G-II

POINT SOURCE PARTICULATE EMISSION ESTIMATES FOR 1980

Source	Part. Tons/Yr	County	City
West Decker Coal	*2136	Bighorn	Decker
Spring Creek Coal	*2001	Bighorn	Decker
East Decker Coal	*1995	Bighorn	Decker
Westmoreland Resources	*1180	Bighorn	Hardin
Montana Power (Corrette)	989	Yellowstone	Billings
Exxon Co. USA	612	Yellowstone	Billings
Cenex	568	Yellowstone	Laurel
Continental Oil Co.	249	Yellowstone	Billings
Bighorn Calcium	* 240	Bighorn	Warren
Great Western Sugar	114	Yellowstone	Billings
Anaconda Co. Refinery	414	Cascade	Great Falls
Philips Petroleum	116	Cascade	Great Falls
Anaconda Co. Butte Operations	*5144	Silver Bow	Butte
Kaiser Cement	475	Jefferson	Montana City
Stauffer Chemical Co.	410	Silver Bow	Ramsay
Anaconda Co. Smelter**	384	Deer Lodge	Anaconda
ASARCO smelter	310	Lewis & Clark	E. Helena
STANCO General	* 238	Deer Lodge	Anaconda
Pfizer Talc	175	Beaverhead	Dillon
Ideal Basic Industries	* 152	Gallatin	Trident
Louisiana Pacific Corp.	* 139	Powell	Deer Lodge
Cyprus Industrial Minerals	132	Gallatin	Three Forks
Western Energy	*4796	Rosebud	Colstrip
Peabody Coal	*1164	Rosebud	Colstrip
Montana Power Co. 1 & 2	887	Rosebud	Colstrip
Holly Sugar	389	Richland	Sidney
Knife River Coal	* 150	Richland	Savage
Northern Cheyenne Forest Prod.	* 140	Rosebud	Ashland
Montana Dakota Utilities	132	Richland	Sidney
Anaconda Aluminum	1331	Flathead	Columbia Falls
Louisiana Pacific Particleboard	761	Missoula	Missoula
Champion Int. Packaging	756	Missoula	Frenchtown
St. Regis Paper Co.	696	Lincoln	Libby
Missoula White Pine & Sash	* 384	Missoula	Missoula
Stoltz Land & Lumber	* 374	Flathead	Columbia Falls
Champion Int.	287	Missoula	Missoula
Plum Creek Lumber	* 275	Lake	Pablo
Flathead Lumber	224	Lake	Polson
American Timber	* 209	Flathead	Olney
Plum Creek Lumber	199	Flathead	Columbia Falls
Flodin Lumber	* 180	Sanders	Thompson Falls
Plum Creek Lumber	149	Flathead	Kalispell
W. I. Forest Prod. Inc.	* 122	Sanders	Thompson Falls
Louisiana Pacific	* 113	Sanders	Trout Creek
Ksanka Lumber	* 112	Lincoln	Fortine

*Fugitive emissions associated with mining and vehicle traffic are included.
**Only six months of operation

APPENDIX H

Prevention of Significant Deterioration

APPENDIX H

PREVENTION OF SIGNIFICANT DETERIORATION

Prevention of Significant Deterioration (PSD) requirements were first introduced as part of the 1977 Amendments to the Clean Air Act.

These PSD requirements set limits for increases in ambient pollution levels and established a system for preconstruction review of new major sources. Three PSD classes have been established. Class I permits very small increases in pollution; Class II allows somewhat larger increases; and Class III allows the air quality to "deteriorate" considerably more. In general, Class I is designed for "pristine" areas where almost any deterioration would be significant. Congress established several types of mandatory Class I areas. These mandatory areas include international parks, wilderness areas larger than 5000 acres, national memorial parks larger than 5000 acres, and existing national parks larger than 6000 acres. All other areas of the country classified as attainment are Class II. Class II limits allow for moderate, well-controlled growth and Class III limits allow pollutant levels to increase considerably.

Table AP-H-I shows the allowable increases for the various classes. Table AP-H-II lists the federal Class I areas for Montana and Figure AP-1-H shows the locations of these areas on a map of Montana.

In 1978 the state of Montana established its own PSD rules. These rules were closely patterned after the Federal rules. In 1979 the EPA was sued by the Alabama Power Company over the Federal PSD rules. The court ruled that EPA had misinterpreted the intent of Congress. As a result the EPA rewrote their rules, which now differ from Montana's rules. The significant difference between the two sets of rules is that the state counts fugitive dust and uncontrolled plant emissions as part of the increment consumption.

Since 1979 the Air Quality Bureau has proceeded with rule-making to adopt an amended PSD rule which resembles the modified EPA rule. Final adoption of the Montana rule is expected in September of 1982. Following adoption the EPA will delegate the entire responsibility for PSD to the state of Montana.

Table AP-H-I

FEDERAL PREVENTION OF SIGNIFICANT DETERIORATION
ALLOWABLE INCREMENTS
Micrograms Per Cubic Meter

	I	II	III	Not to exceed
Particulates				
Annual Geo. Mean	5	19	37	75
Maximum 24-hour	10	37	75	150
Sulfur Dioxide				
Annual Arith. Mean	2	20	40	80
Maximum 24-hour	5	91	182	365
Maximum 3-hour	25	512	700	1300

Table AP-H-II

MONTANA FEDERAL CLASS I AREAS

Area	Location
Glacier National Park	NE Kalispell
Yellowstone National Park	S Bozeman
Bob Marshall Wilderness Area	SE Kalispell
Anaconda-Pintlar Wilderness Area	SW Anaconda
Selway-Bitterroot Wilderness Area	W Hamilton
Cabinet Mountains Wilderness Area	S Libby
Scapegoat Wilderness Area	NW Helena
Gates of the Mountains Wilderness Area	NE Helena
Mission Mountains Wilderness Area	SE Polson
Red Rock Lakes National Wildlife Refuge	S Virginia City
Medicine Lake National Wildlife Refuge	S Plentywood
U. L. Bend National Wildlife Refuge	SW Glasgow
Northern Cheyenne Reservation	SE Hardin
Flathead Indian Reservation	Near Polson & Ronan

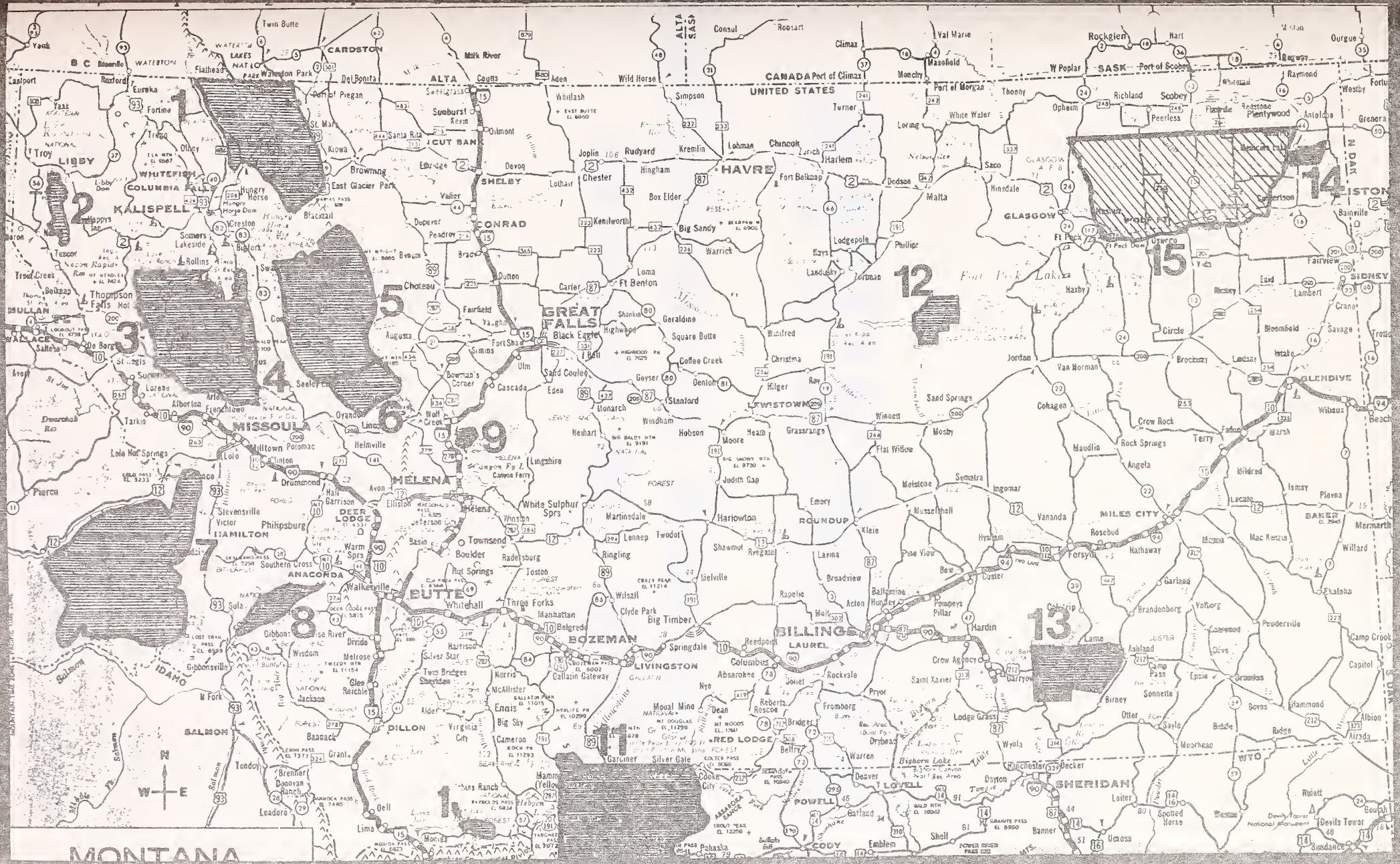


Figure AP-I-H
PSD CLASS I AREAS IN MONTANA

1. Glacier National Park
2. Cabinet Mountain Wilderness
3. Flathead Indian Reservation
4. Mission Mountain Wilderness
5. Bob Marshall Wilderness
6. Lincoln Scapegoat Wilderness
7. Selway Bitterroot Wilderness
8. Anaconda Pintlar Wilderness
9. Gates of the Mountains Wilderness
10. Red Rock Lakes National Wildlife Refuge
11. Yellowstone National Park
12. U L Bend Wilderness Area
13. Northern Cheyenne Indian Reservation
14. Medicine Lake National Wildlife Refuge
15. Fort Peck Indian Reservation (proposed)

APPENDIX I

Unforeseen Emergency — Mount St. Helens

APPENDIX I

UNFORESEEN EMERGENCY - MOUNT ST. HELENS

On Sunday, May 18, 1980, Mount St. Helens erupted in the State of Washington. By early evening the western edge of Montana started to receive a dusting of ash from the volcano.

The Bureau has received a number of requests for information and data collected during this emergency. To meet these needs, we have put together a variety of information. First, we have included a personal account by one of the bureau members entitled "Week of the Ash"; this gives a chronology of events during the week following May 18.

Table AP-I-I gives ash concentrations taken from various state hi-vol sites on approximately four-hour intervals. Figure AP-1-I graphs Missoula's data. Highest concentrations occurred on Monday, with another peak occurring on Wednesday. Wednesday's highs were due to re-entrained dust caused by winds picking the dust off the ground.

WEEK OF THE ASH
By Stan Sternberg

Eight a.m., Monday morning, May 19, 1980. It was time for the regularly scheduled weekly staff meeting. The time for the meeting was the only thing routine that day. The agenda's one topic: the volcano in Washington had erupted and ash was pouring into Montana - what are we going to do?

The telephone was ringing off the hook. No secretaries had shown. Mike Roach, Air Quality Bureau Chief, called the meeting to order. "Take those phones off the hook", someone yelled, "how can we rack our brains with all that ringing?" The phones were taken off. Quiet. The chief asked the first question, "What do we know about this thing?" One by one we went around the table. Apparently the ash was fairly typical crustal earth material: mostly aluminum, calcium, iron, potassium, magnesium and silicon.

"What ambient air data do we have?" Through a series of phone calls, Mike Machler had gotten the operators in Butte and Missoula to start running air sampling filters at midnight. The first data that came in showed a 24-hour reading for Sunday in Missoula of 3071 micrograms per cubic meter. We had never seen readings of that magnitude.

"What emergency powers do we have?" Details were sketchy but we did have an Emergency Avoidance Plan under the State Implementation Plan. This was a source specific curtailment plan; we could shut down industries if the ambient levels were above 875 micrograms per cubic meter. We also had some emergency provisions to control fugitive dust. This would allow us to slow down traffic to 15 mph in urban areas.

With what information we had during that early morning meeting, Mike Roach assigned the staff a series of duties. Dave Maughan: call around and find out more about the composition of the ash. Bob Raisch: find out what emergency provisions we have and if we can declare an emergency. Jon Bolstad: call other state and regional agencies and find out what they know as well as what the volcano is doing. Dennis Haddow: call physicians and determine what health effects the ash may have. Stan Sternberg: set up monitoring in Helena and East Helena. The rest of the staff were to stay close and answer phones. Another meeting was set for 11 a.m. A voice called out, "Get those phones back on line and let 'em ring."

This was the start of the week of the ash. The outside temperatures were hot; the ash and closed windows brought a muggy, close, brow-wiping environment.

By Monday afternoon a functional monitoring network had been established. Operators in several counties were running filters every four hours and calling in the data.

At 1:30 p.m. on Monday, the Governor declared a statewide emergency. On Tuesday, the first counties were withdrawn from the emergency, they were in the southwest and south central portions of the state. Counties in the east were phased down through the warning and alert levels. The ash seemed to stick stubbornly in the valleys of the west. Missoula had problems with reentrainment (ash being picked up off the ground by wind and cars).

On Tuesday afternoon, Bob Raisch and Hal Robbins flew over a portion of the state to evaluate the situation. This included flying over Havre, Kalispell, and Missoula. The bulk of the ash was between 0 and 5,000 feet and the highest ash elevation was around 14,000 feet. Bob said he could

see the top of the Sweetgrass Mountains for 60 miles; the bottoms could be seen for only five miles. Mike Machler took a similar flyover on the following day.

The scene at the Cogswell Building was a bee hive. Thousands of phone calls came in. Calculators were humming. A board was set up to record the data. The office was manned twenty-four hours a day. Some staff members didn't sleep for two days.

On Thursday, Kalispell got some rain. "Come on rain!" the staff chanted. By Friday afternoon the whole western part of the state had rain. The ash was washed out of the sky and by 1:00 p.m. on Friday the emergency was lifted from all counties. The phone was still ringing but less frequently. At 5 o'clock we all went home. The rain looked great....fresh ....clean....ah!

AMBIENT AIR QUALITY DATA--VOLCANIC ASH FROM MOUNT ST. HELENS--MAY 18, 1980 ERUPTION--TOTAL SUSPENDED PARTICULATES--MICROGRAMS PER CUBIC METER ($\mu g/m^3$)

SITES	5/18	5/19					5/20						5/21						5/22						5/23		
Missoula Courthouse	0000/ 2400 3071 3071	0000 1200 9298 6368		1245/ 1545 7620 7088	1530/ 1930 19228 9818	1930/ 2330 8836 8835	2230/ 0230 2520 7908	0230/ 0630 844 7874	0630/ 1030 676 6177		1420/ 1815 2055 2336	1820/ 2220 3197 1858	2220/ 0220 1848 1724	0220/ 0620 1231 1801	0620/ 1020 1130 1886	1020/ 1420 1648 1847	1420/ 1820 7617 2774	1820/ 2220 4853 3050	2220/ 0230 2341 3132	0220/ 0620 1309 3145	0620/ 1000 784 3092	0950/ 1350 894 2992	1350/ 1750 941 1659	1750/ 2150 274 1099	2150/ 0640 31 477	0640/ 1040 50 357	
Butte Hebgen Park		0000/ 0800 3439 3439	0800/ 1200 2513 3186	1200/ 1600 1642 2849	1600/ 1930 431 2429	1930/ 2330 327 2353	2300/ 0215 818 1854	0215/ 0620 203 1578	0620/ 1020 263 665	1020/ 1415 272 335	1420/ 1800 252 305	1805/ 2200 276 290		2200/ 0510 325 281		0550/ 1350 325 306		1350/ 2150 608 420		2050/ 0500 140 358		0630/ 1345 387 453		1400/ 2200 332 280	2200/ 0600 50 252		
Gt.Falls CCHD		0000/ 1030 7165 7165		1200/ 1515 3898 6393	1600/ 1900 4399 5943	1935/ 2135 4494 6889	2235/ 0145 3372 4345	0155/ 0600 1247 3828	0600/ 1015 1090 3110	1015/ 1415 304 2483	1420/ 1720 384 1547	1738/ 2150 431 1082	2150/ 0200 778 724	0200/ 0520 563 607	0525 0910 281 437	0915/ 1315 208 422	1320/ 1705 151 403			1710/ 0510 538 376	0510/ 0900 289 377	0910/ 1310 247 387	1310/ 1710 574 454		1710/ 0515 103 237	0515/ 0915 57 197	
Billings Downtown			0815/ 1115 2694 2694	1145/ 1545 724 1568	1545/ 1945 480 1173	1945/ 2345 460 1020	2300/ 0230 198 855	0230/ 0630 218 696	0630/ 1030 358 643	1030/ 1430 201 335	1430/ 1815 204 266	1815/ 2215 264 237		2230/ 0630 124 212	0630/ 1030 318 206		1030/ 1715 215 210			1730/ 0545 164 215			0600/ 1800 227 195		1800/ 0500 284 254		
Helena Cogswell			1000/ 1230 7889 7889	1238/ 1548 3007 5226	1558 1922 1963 3975	1930/ 2330 1835 3405	2232/ 0222 1115 2874	0227/ 0544 643 2503	0553/ 0958 790 2212	1000/ 1430 838 1159	1435/ 1817 329 869	1820/ 2220 282 668	2220/ 0220 265 526	0220/ 0520 196 471	0525/ 1020 546 431	1020/ 1420 1833 587	1420/ 1823 661 631	1830/ 2230 422 672	2230/ 0230 287 672	0230/ 0515 189 657	0515/ 1015 315 623	1015/ 1415 529 407	1425/ 1825 592 396	1825/ 2223 171 352	2225/ 0610 95 302		
Kalispell						1345/ 2100 7366 7366		2130/ 0740 3749 5287		0930/ 1345 2767 4766	1545/ 1945 1796 3132	2015/ 2210 4483 3229		2245/ 0510 2715 2855	0540/ 1010 1176 2393	1100/ 1330 2329 2303	1340/ 1740 1503 2231	1745/ 2210 2630 2160		2210/ 0510 298 1511	0615/ 1015 135 1231		1100/ 1815 236 747			1830/ 0900 14 88	
Hardin								0000/ 0630 250 250																			
Colstrip									0930/ 1130 1976 1976	1400/ 1530 514 1349		2030/ 2200 903 1215		0000/ 0515 183 687	0515/ 0940 442 402												
Scobey									0000/ 1200 1491 1491		1210/ 1700 908 1319	1705/ 2200 727 1185	2210/ 0200 765 1089	0210/ 0600 614 943	0610/ 1000 550 722	1150/ 1400 129 662	1405/ 1800 134 491	1710/ 2100 72 388		2130/ 0400 81 186	0430/ 0900 111 141		0905/ 1700 51 76		1735/ 0525 101 87		
Havre											1310/ 1800 1045 1045	1804/ 2206 365 743			2251/ 0904 629 683		1147/ 1757 190 453	1800/ 2200 255 423			2205/ 0905 438 338		1252/ 2156 662 539		2200/ 0910 65 333		
Anaconda Lincoln School							0000/ 0400 482 482		0800/ 1200 659 570		1200/ 1700 302 467	1715/ 2200 156 381	2210/ 0250 69 324														
Libby												1800/ 2200 3395 3395			2200/ 1000 616 1311	1200/ 1450 588 1213	1215/ 1720 684 630			1730/ 0530 504 557	0530/ 1725 447 475					1735/ 0720 133 272	

KEY: 1530/ Sample start time
1930 Sample stop time
485 Actual reading ($\mu g/m^3$)
1280 Running 24 hour average ($\mu g/m^3$)

Table AP-I-I

MONTANA - MOUNT ST. HELENS' ASH CONCENTRATIONS

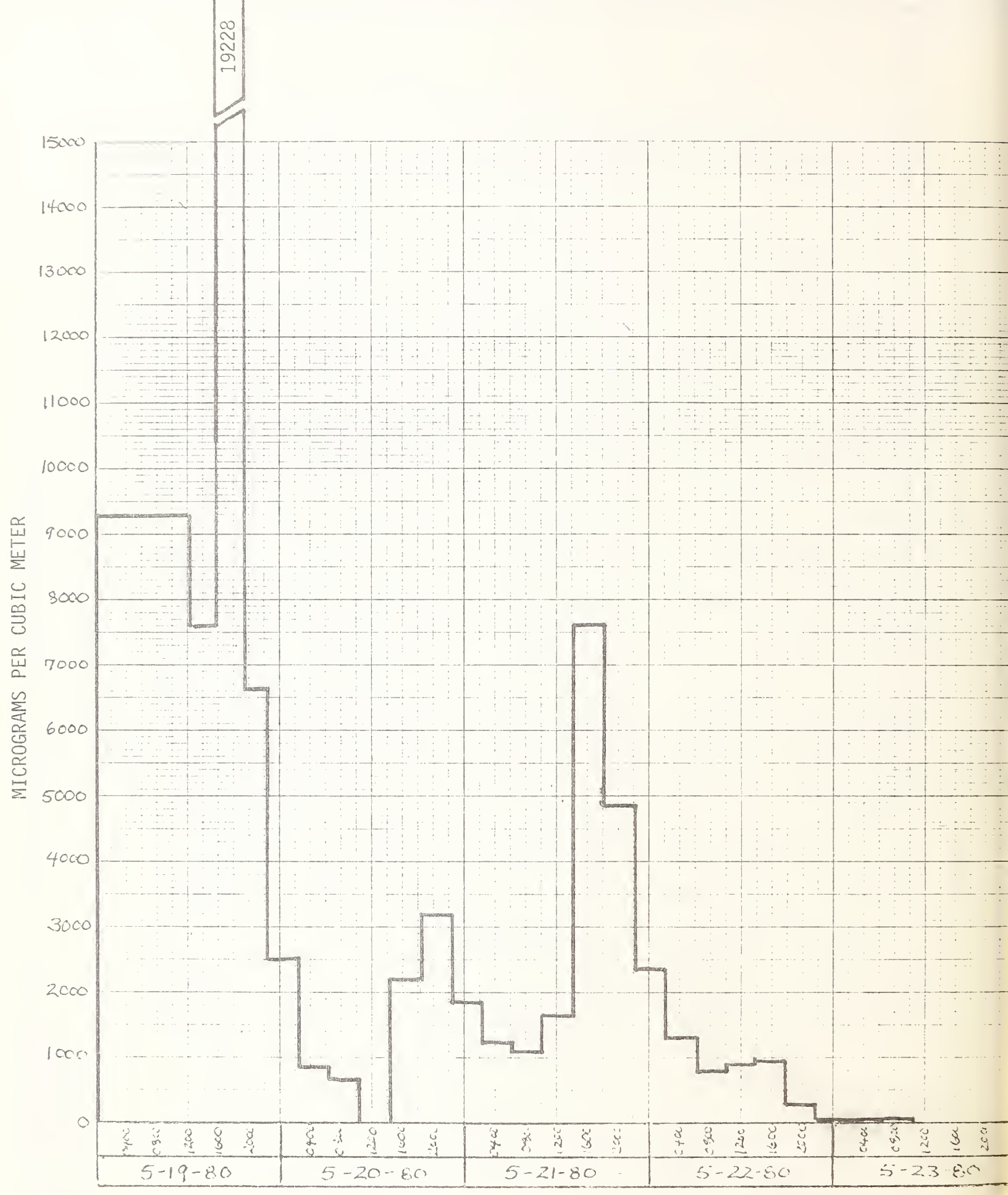


Figure AP-1-I

ASH CONCENTRATIONS IN MISSOULA
COURTHOUSE ROOF--ACTUAL READINGS

APPENDIX J

Air Quality Data Outputs

APPENDIX J

AIR QUALITY DATA OUTPUTS

This appendix has been put together to show the data user the varieties of data outputs.

The Bureau uses an adaptation of the EPA's Comprehensive Data Handling System (CDHS). This system has two subsystems: Air Quality Data Handling System (AQDHS) and Emission Inventory System/Permits and Registration (EIS/P&R).

The following outputs are generated by AQDHS, EIS/P&R, and other systems that have been programmed to our needs. They are listed as follows:

AQDHS Daily

AP-1-J Kalispell-Universal Athletics - TSP 1981
AP-2-J East Helena - Hasties Residence - Lead 1981
AP-3-J Scobey - Hanrahan - TSP 1981

AQDHS Hourly

AP-4-J Billings - Taft School - SO_2 March 1981
AP-5-J Flathead County - Airport - Wind Direction - October 1981
AP-6-J Flathead County - Airport - Wind Speed - October 1981

Upper Air Summary

AP-7-J Flathead County - Airport - 100 M Winds - September 1980

Acoustic Radar Summary

AP-8-J Billings Vo-Tech - Two Hour Stability Analysis - April 1981

TSP Plots

AP-9-J Billings - Grand Avenue School - TSP - Three Year Plot - 1979-1981
AP-10-J Columbia Falls - Anders - TSP - Three Year Plot - 1979-1981
AP-11-J Havre - Central City Building - TSP - One Year Plot - 1981
AP-12-J Great Falls - Fire Station - TSP - One Year Plot - 1981

CO Plot - Diurnal

AP-13-J Missoula - Malfunction Junction - CO (Monday-Friday) October 1981

Surface Wind Rose

AP-14-J Flathead County Airport - Monthly Wind Roses - September-December 1981

EIS/P&R Summary Report

AP-15-J Sawmill - (Name Deleted) - Emission Estimates - Wood Waste Burner
Note: This report lists point sources and pollutant emission estimates from industries in the state.

FIGURE AP-I-J

KALISPELL - UNIVERSAL ATHLETICS - TSP 1981

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT
REPORT DATE: 07/14/82 PAGE 1231

PARAMETER: SUSPENDED PARTICULATE (11101) UNITS: MICROGRAMS/CUBIC METER (01) MIN DET: 1 DECIMAL CODE: 0
COLLECTION METHOD: HI-VOL (91) ANALYSIS METHOD: GRAVIMETRIC SAMPLING INTERVAL: DAILY

SITE: KALISPELL - UNIVERSAL ATHLETIC - HIVOL, DICHOT (0800-015) AGENCY: STATE
PROJECT: POPULATION-ORIENTED SURV. (01) YEAR: 1981 MONTH: (F)

MONTANA STANDARD: 000200MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
FEDERAL PRIMARY STANDARD: 000260MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
FEDERAL SECONDARY STANDARD: 000150MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01									70	75			2	73	75
02								83					1	83	83
03		211				76	87						3	125	211
04	24			75	82								3	60	82
05			134										1	134	134
06											180	57	2	119	180
07										59			1	59	59
08								79					1	79	79
09		69				50	75						3	65	75
10	144			107	58								3	103	144
11			177										1	177	177
12											77	51	2	64	77
13									78	64			2	71	78
14								186					1	186	186
15		38				95	31						3	55	95
16	174			100	66								3	114	174
17			122										1	122	122
18											79	52	2	66	79
19									163	133			2	148	163
20								92					1	92	92
21						86							1	86	86
22	86			46	64								3	65	86
23			130										1	130	130
24											106	53	2	80	106
25									86	58			2	72	86
26								101					1	101	101
27						138	75						2	107	138
28	45			48	88								3	60	88
29			42										1	42	42
30											136	70	2	103	136
31										123			1	123	123
NO	5	3	5	5	5	5	4	5	4	6	5	5	57		
MEAN	95	106	121	75	72	89	87	108	99	85	116	57		90	
MAX	174	211	177	107	88	138	87	186	163	133	180	70			211

NUMBER OF TIMES ABOVE MONTANA VALUE: 1
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 6

GMEAN 74.70 82.65 109.57 70.74 71.13 84.40 82.40 102.53 93.53 80.18 109.55 56.20 YTD-GMEAN 80.63

Figure AP-2-J

EAST HELENA - HASTIES RESIDENCE - LEAD 1981

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT — REPORT DATE: 07/14/82 — PAGE 1455

PARAMETER: LEAD — (12128) UNITS: MICROGRAMS/CUBIC METER — (01) MIN DET: .08 DECIMAL CODE: 2
COLLECTION METHOD: HI-VOL — (92) ANALYSIS METHOD: ATOMIC ABSORPTION — SAMPLING INTERVAL: DAILY

SITE: LEWIS & CLARK CO - HASTIE RESIDENCE - HIVOL.SULFATION — (0660-002) AGENCY: STATE — (F)
PROJECT: SOURCE-ORIENTED AMBIENT SURV. (02) — YEAR: 1981 MONTH:

MONTANA STANDARD: 01.500MICROGRAMS/CUBIC METER-90 DAY MEAN
FEDERAL PRIMARY STANDARD: 01.500MICROGRAMS/CUBIC METER-CALENDAR MEAN
FEDERAL SECONDARY STANDARD:

DAY	MONTH JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01				0.49	2.42				1.36	2.55	2.20		5	1.80	2.55
02			1.47					0.75					2	1.11	1.47
03		13.70				0.83	3.63					3.23	4	5.40	13.70
04	1.67			0.57	1.31					2.41			4	1.34	2.41
05		10.70						0.79					2	5.75	10.70
06							1.69				3.80	1.79	3	2.49	3.80
07				6.07	0.37					4.38			3	3.61	6.07
08			0.75					0.39					2	0.57	0.75
09		0.97				1.29	1.99				2.29		4	1.64	2.29
10	4.42			3.79	0.54					0.34			4	2.27	4.42
11								1.36					1	1.36	1.36
12		1.40				0.20	1.18				3.90	3.58	5	2.65	3.90
13				0.94	2.15				3.16	2.07			4	2.08	3.16
14			6.20					7.52					2	6.86	7.52
15		8.04				0.77	0.51				3.09	0.49	5	2.58	8.04
16	2.67			1.73	0.08				1.40	1.70			5	1.52	2.67
17			0.19					3.07					2	1.63	3.07
18						0.33	3.99				0.52	2.16	4	1.75	3.99
19				0.57	2.11				6.35	3.18			4	3.65	6.35
20			0.44					2.20					2	1.32	2.20
21		0.43				2.83	7.61				6.85		4	4.38	7.61
22	3.95			0.42	2.98								3	2.45	3.95
23								1.20					1	1.20	1.20
24		1.20	1.53			1.22	0.16				0.77		5	0.98	1.53
25				0.62					0.32				2	0.47	0.62
26			1.39					3.03		4.51			3	2.98	4.51
27						3.98	0.84				1.46	1.09	4	1.84	3.98
28	1.79			1.32	4.46								3	2.52	4.46
29			1.72					2.97		0.63			3	1.77	2.97
30						1.14	0.60				2.59	3.74	4	2.02	3.74
31					0.99								1	0.99	0.99
NO	5	7	8	10	10	9	10	10	5	9	10	7	100		
MEAN	2.78	5.18	1.71	1.65	1.74	1.40	2.26	2.33	2.52	2.42	2.75	2.30		2.34	
MAX	4.42	13.70	6.20	6.07	4.46	3.98	7.61	7.52	6.35	4.51	6.85	3.74			13.70

NUMBER OF TIMES ABOVE MONTANA VALUE: 2
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 2
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

Figure AP-3-J

SCOBEY - HANRAHAN - TSP 1981

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT — REPORT DATE: 07/14/82 — PAGE 828

PARAMETER: SUSPENDED PARTICULATE (11101) UNITS: MICROGRAMS/CUBIC METER (01) MIN DET: 1 DECIMAL CODE: 0
COLLECTION METHOD: HI-VOL (91) ANALYSIS METHOD: GRAVIMETRIC SAMPLING INTERVAL: DAILY

SITE: DANIELS CO - SCOBEY - HANRAHAN (0340-004) AGENCY: STATE
PROJECT: BACKGROUND SURVEILLANCE (03) YEAR: 1981 MONTH: (F)

MONTANA STANDARD: 000200MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
FEDERAL PRIMARY STANDARD: 000260MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR
FEDERAL SECONDARY STANDARD: 000150MICROGRAMS/CUBIC METER-24 HR MAX-1 PER YEAR

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	NO.	MEAN	MAX
01									97	19	11		3	42	97
02								27					1	27	27
03		21				20	35						3	25	35
04	8			50	43								3	34	50
05			16										1	16	16
06											14		1	14	14
07										28			1	28	28
08								37					1	37	37
09						14	42						2	28	42
10	16				32								2	24	32
11			7										1	7	7
12											15	14	2	15	15
13									37	9			2	23	37
14								73					1	73	73
15		10				14	21						3	15	21
16	9			544	100								3	220	544
17			12										1	12	12
18											27	13	2	20	27
19										13			1	13	13
20								53					1	53	53
21		4					56						2	31	58
22	4			92	144								3	80	144
23			12										1	12	12
24											5	8	2	7	8
25										7			1	7	7
26								80					1	80	80
27		11				31	41						3	28	41
28	11			294	47								3	117	294
29			15										1	15	15
30												16	1	16	16
NO	5	4	5	4	5	4	5	5	2	5	5	4	53		
MEAN	10	12	12	245	74	20	39	54	67	15	14	13		45	
MAX	16	21	16	544	144	31	58	80	97	28	27	16			544

NUMBER OF TIMES ABOVE MONTANA VALUE: 2
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 2
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 2

GMEAN 8.72 9.80 11.93 164.69 62.93 18.67 37.42 49.89 59.90 13.42 12.55 12.35 YTD-GMEAN 22.98

Figure AP-4-J

BILLINGS - TAFT SCHOOL - SO_2 - MARCH, 1981

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT

REPORT DATE: 07/14/82 PAGE 412

PARAMETER: SULFUR DIOXIDE (42401) UNITS: PARTS PER MILLION (07) MIN DET: .005 DECIMAL CODE: 3
COLLECTION METHOD: INSTRUMENTAL (20) ANALYSIS METHOD: PULSED FLUORESCENT SAMPLING INTERVAL: 01 HOURS

SITE: BILLINGS - TAFT SCHOOL _ SO2, TSP (0080-062) AGENCY: STATE
PROJECT: POPULATION-ORIENTED SURV. (01) (F)
YEAR: 1981 MONTH: MARCH

MONTANA STANDARD: 00.500PARTS PER MILLION-1 HR MAX-18 PER YEAR
FEDERAL PRIMARY STANDARD: 00.140PARTS PER MILLION-24 HR MAX-1 PER YEAR
FEDERAL SECONDARY STANDARD: 00.500PARTS PER MILLION-3 HR MEAN-1 PER YEAR

DAY	HOUR																								
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVG MAX
01	.059	.064	.015	.011	.009	.007	.007	.008	.009	.026	.032	.123	.132	.047	.036	.024	.038	.020	.012	.008	.011	.007	.029	.011	.031 .132
02	.015	.011	.007	.006	.006	.007	.007	.010	.010	.007	.021	.019	.016	.005	.004	.004	.004	.005	.006	.009	.009	.012	.013	.012	.009 .021
03	.012	.011	.008	.007	.007	.009	.009	.012	.012	.029	.024	.015									.002	.006	.005	.004	.011 .029
04	.006	.007	.004	.004	.004	.004	.004	.009	.005	.022	.036	.014	.024	.011	.001	.014	.005	.002	.002	.001	.003	.001	.005	.010	.008 .036
05	.010	.006	.007	.006	.005	.004	.004	.008	.010	.007	.021	.007	.006	.003	.003	.009	.020	.001	.001	.003	.008	.003	.031	.029	.009 .031
06	.017	.014	.025	.019	.013	.019	.035	.034	.056	.040	.018	.016	.019	.017	.019	.008	.004	.010	.004	.001	.000	.000	.000	.001	.016 .056
07	.001	.001	.001	.004	.003	.003	.003	.000	.000	.000	.000	.007	.047	.026	.026	.027	.037	.010	.016	.000	.003	.003	.002	.001	.009 .047
08	.003	.002	.003	.003	.002	.002	.001	.002	.008	.012	.021	.015	.010	.044	.026	.016	.032	.015	.015	.007	.006	.009	.007	.004	.011 .044
09	.005	.002	.004	.003	.003	.003	.004	.003	.005	.003	.003	.000	.004	.052	.009	.001	.002	.002	.004	.006	.000	.004	.004	.004	.006 .052
10	.004	.002	.002	.002	.001	.002	.003	.008	.008	.013	.021	.026	.004	.002	.004	.001	.001	.001	.004	.008	.004	.002	.003	.003	.005 .021
11	.006	.005	.005	.004	.004	.004	.005	.006	.004	.016	.018	.006	.002	.004	.042	.030	.031	.017	.003	.010	.012	.005	.009	.020	.011 .042
12	.013	.009	.005	.007	.007	.010	.007	.009	.010	.024	.033	.012	.013	.092	.049	.058	.056	.026	.018	.004	.005	.007	.007	.003	.020 .092
13	.005	.071	.039	.006	.004	.006	.006	.007	.006	.022	.025	.025	.019	.020	.026	.008	.006	.001	.004	.006	.003	.008	.006	.007	.014 .071
14	.009	.007	.017	.013	.016	.011	.005	.010	.023	.017	.009	.001	.001	.001	.000	.001	.001	.003	.009	.005	.006	.015	.016	.016	.009 .023
15	.013	.014	.016	.011	.010	.012	.006	.006	.008	.013	.021	.007	.002	.002	.001	.003	.001	.001	.004	.007	.004	.004	.006	.007	.008 .021
16	.008	.009	.006	.004	.004	.006	.008	.010	.009	.014	.003	.003	.001	.001	.001	.001	.001	.002	.005	.005	.001	.001	.000	.000	.005 .014
17	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000 .000
18	.000	.000	.000	.000	.000	.000	.000	.000	.000	.008	.010	.003	.012	.010	.031	.017	.003	.000	.000	.000	.000	.000	.000	.001	.004 .031
19	.021	.021	.024	.031	.001	.002	.037	.036	.006	.000	.000	.010	.015	.075	.031		.034	.000	.023	.022	.026	.014	.007	.003	.019 .075
20	.010	.001	.000	.000	.001	.000	.001		.005	.014	.139	.053	.052	.061	.032	.048	.037	.029	.077	.049	.056	.028	.007		.030 .139
21	.022	.035	.009	.002	.002	.002	.004	.014	.008	.026	.005	.002	.001	.000	.000	.000	.027	.036	.029	.046	.013	.008	.005	.003	.012 .046
22	.011	.022	.005	.010	.006	.006	.004	.004	.012	.010	.002	.002	.000	.000	.016	.001	.002	.000	.004	.000	.001	.004	.003	.002	.005 .022
23	.003	.003	.002	.002	.002	.007	.003	.004	.006	.001	.001	.001	.001	.001	.001	.001	.001	.001	.002	.007	.005	.007	.005	.005	.003 .007
24	.003	.002	.003	.004	.003	.003	.004	.004	.025	.005	.006	.002	.001	.001	.001	.001	.001	.001	.001	.002	.020	.007	.003	.004	.004 .025
25	.003	.002	.003	.005	.005	.005	.004	.004	.006	.018	.213	.156	.100	.036	.009	.009	.048	.161	.014	.000	.001	.001	.008	.035	.036 .213
26	.103	.057	.008	.002	.004	.004	.007	.014	.007	.017	.030	.027	.062	.025	.029	.045	.057	.026	.022	.007	.009	.008	.009	.007	.024 .103
27	.004	.002	.002	.002	.008	.020	.007	.001	.001	.006	.006	.005	.004	.001	.001	.001	.002	.003	.003	.002	.001	.001	.002	.001	.004 .020
28	.001	.001	.001	.001	.002	.004	.007	.007	.007	.003	.003	.004	.001	.001	.001	.001	.001	.001	.001	.002	.001	.005	.005	.004	.003 .007
29	.003	.002	.007	.004	.008	.011	.013	.018	.004	.003	.003	.001	.000	.000	.001	.000	.000	.000	.000	.000	.000	.000	.001	.000	.003 .018
30	.003	.000	.000	.000	.000	.001	.001	.001	.002	.002	.001	.002	.002	.002	.001	.001	.001	.001	.001	.001	.000	.000	.000	.000	.001 .003
31	.000	.000	.000	.000	.000	.000	.001	.001	.001	.001	.001	.001	.001	.001		.000	.000	.001	.002	.002	.002	.001	.003	.005	.001 .005
	31	31	31	31	31	31	31	30	31	31	31	31	30	30	28	29	30	30	30	30	31	31	31	30	NO
	.012	.012	.007	.006	.005	.006	.007	.008	.009	.012	.024	.018	.019	.018	.014	.011	.014	.013	.010	.007	.007	.006	.007	.007	MEAN
	.103	.071	.039	.031	.016	.020	.037	.036	.056	.040	.213	.156	.132	.092	.049	.058	.057	.161	.077	.049	.056	.028	.031	.035	MAX

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 3
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

TOTAL NBR READINGS 731
MONTHLY MEAN .011
MONTHLY MAX .213

Figure AP-5-J

FLATHEAD COUNTY - AIRPORT - WIND DIRECTION, OCTOBER, 1981

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT
REPORT DATE: 07/14/82 PAGE 934

PARAMETER: WIND DIRECTION (61102) UNITS: DEGREES (14) MIN DET: 1 DECIMAL CODE: 0
COLLECTION METHOD: INSTRUMENTAL (50) ANALYSIS METHOD: DAS/MANUAL AVERAGE SAMPLING INTERVAL: 01 HOURS

SITE: FLATHEAD CO - AIRPORT - FLATHEAD STUDY MET (0480-304) AGENCY: STATE (F)
PROJECT: SPECIAL STUDIES (05) YEAR: 1981 MONTH: OCTOBER

MONTANA STANDARD:
FEDERAL PRIMARY STANDARD:
FEDERAL SECONDARY STANDARD:

DAY	HOUR																								
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVG MAX
01	246	239	154	187	276	67	101	26	120	229	207	203	203	195	192	186	185	191	187	208	222	223	264	270	190. 276
02	230	232	274	203	195	205	220	222	221	199	230	254	248	266	260	206	273	276	273	281	288	181	187	191	240 288
03	190	349	23	88	253	230	184	121	27	23	227	255	294	359	317	302	359	232	226	264	22	198	217	298	208 359
04	154	24	15	106	359	192	154	251	66	248	251	210	197	230	228	90	89	40	26	355	11	306	44	313	164 359
05	324	69	33	303	62	290	327	178	228	82	174	194	195	196	188	168	187	160	197	1	38	16	36	283	165 327
06	291	14	49	23	348	105	52	4	32	32	343	229	220	213	218	241	246	231	259	43	20	75	254	240	160 346
07	75	34	350	99	39	303	350	69	72	250	184	199	190	341	299	264	220	262	286	290	269	228	228	222	214 356
08	209	221	231	205	199	198	195	208	202	213	172	187	211	285	270	261	240	223	194	215	244	235	190	242	219 285
09	232	26	353	350	9	45	33	244	220	204	207	257	264	284	271	273	275	274	248	214	201	230	257	194	215 356
10	205	204	46	270	290	350	345	297	218	40	96	170	192	11	41	14	11	346	27	36	3	8	1	358	151 358
11	7	20	39	350	3	353	1	4	10	27	14	27	54	70	61	65	56	46	45	43	39	40	37	32	60 356
12	28	27	29	12	13	10	14	15	16	11	22	48	73	65	56	94	101	198	136	54	37	8	340	199	70 340
13	79	65	22	20	12	344	351	347	4	31	55	27	240	207	162	193	202	193	191	7	35	51	20	234	131 351
14	200	52	356	329	102	139	293	113	200	213	197	202	207	206	216	237	229	201	202	313	20	45	64	51	183 356
15	2	275	31	359	30	206	343	349	229	63	60	92	131	200	212	205	211	201	324	61	12	25	288	63	169 359
16	29	14	302	137	4	71	250	225	35	116	193	213	206	213	209	218	220	258	322	66	273	356	61	330	180 356
17	43	5	39	7	10	307	220	3	328	340	199	159	194	210	207	210	214	222	252	18	46	348	28	31	152 348
18	19	11	29	30	310	102	30	153	73	47	186	217	219	205	213	221	229	218	228	262	30	28	37	17	131 316
19	43	30	219	110	30	304	243	17	202	173	56	277	218	204	284	287	311	263	185	188	253	44	39	46	170 311
20	57	51	40	44	43	47	63	44	65	65	51	73	68	70	79	80	75	66	259	352	316	319	160	1	106 352
21	347	351	206	23	10	0	259	356	42	56	53	312	266	209	208	203	205	206	41	26	10	322	116	2	162 351
22	41	300	12	45	30	275	179	0	241	117	194	206	221	151	210	214	222	225	54	14	336	40	312	349	170 360
23	36	312	64	203	339	22	41	302	60	54	92	337	244	206	359	308	231	189	64	205	289	48	23	11	176 359
24	4	340	73	208	219	37	343	205	67	349	322	224	230	197	193	192	187	193	202	262	293	231	243	111	211 349
25	322	243	257	242	247	234	302	256	54	201	226	183	192	186	196	222	218	181	194	207	208	205	209	218	322
26	216	202	207	217	223	256	203	256	253	243	231	193	205	223	201	236	216	214	203	187	224	239	211	194	222 268
27	186	189	191	197	219	295	94	185	253	103	91	94	46	89	37	91	14	51	340	107	327	360	259	319	172 360
28	75	356	64	316	61	6	347	328	336	33	21	43	23	236	149	204	270	253	208	213	226	215	198	209	184 356
29	17	33	47	148	216	268	50	298	15	50	108	103	141	176	196	201	229	282	173	199	212	228	214	209	159 298
30	216	195	212	216	317	16	213	234	226	219	250	259	250	265	267	259	264	268	222	225	239	227	213	206	228 317
31	259	295	290	233	266	253	261	268	228	251	257	231	222	206	210	261	309	267	259	164	210	359	150	49	243 359
	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	NO
	141	159	139	175	155	185	196	181	141	142	162	162	169	205	201	205	205	210	194	165	160	175	158	177	MEAN
	347	360	356	359	359	353	356	349	336	349	345	337	294	359	359	308	359	346	340	355	336	360	340	358	MAX

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

TOTAL NBR READINGS 744
MONTHLY MEAN 175
MONTHLY MAX 360

Figure AP-6-J

FLATHEAD COUNTY - AIRPORT - WIND SPEED - OCTOBER, 1981

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY DATA REPORT — REPORT DATE: 07/14/82 — PAGE 923

PARAMETER: WIND SPEED (61101) UNITS: METERS PER SECOND (11) MIN DET: .4 DECIMAL CODE: 1
COLLECTION METHOD: INSTRUMENTAL (50) ANALYSIS METHOD: DAS/MANUAL AVERAGE SAMPLING INTERVAL: 01 HOURS

SITE: FLATHEAD CO - AIRPORT - FLATHEAD STUDY MET (0480-304) AGENCY: STATE (F)
PROJECT: SPECIAL STUDIES (05) YEAR: 1981 MONTH: OCTOBER

MONTANA STANDARD:
FEDERAL PRIMARY STANDARD:
FEDERAL SECONDARY STANDARD:

DAY	HOUR 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVG	MAX
01	1.3	.4	.4	.6	.2	.6	.4	.3	.3	1.9	1.2	4.1	5.1	6.4	5.9	6.6	6.5	4.8	3.9	2.3	4.2	3.2	2.9	3.2	2.8	6.6
02	4.2	3.6	2.6	4.2	5.8	4.2	5.2	3.4	4.1	5.9	8.3	7.6	8.1	7.6	6.6	6.7	4.9	2.9	3.4	2.5	2.3	1.3	1.3	.7	4.5	8.3
03	1.6	.9	1.3	1.5	1.4	1.6	1.1	.2	.2	.3	.6	2.3	4.0	4.0	3.7	2.5	1.5	1.7	3.3	1.6	1.7	1.2	1.0	.7	1.7	4.0
04	1.1	1.3	1.2	.5	.2	.2	.3	.7	.6	1.1	.3	1.5	2.2	2.7	3.9	3.7	4.9	2.4	1.2	.7	.9	.6	.2	1.2	1.4	4.9
05	.2	.2	.2	.5	.2	.2	.4	.2	.3	.6	.9	1.6	2.4	3.9	4.4	4.6	3.6	2.4	.8	1.1	.2	.7	.5	.2	1.3	4.6
06	.7	.2	.2	.2	.2	.2	.2	.2	.2	.2	.5	1.0	1.6	2.2	1.6	2.0	2.5	2.1	1.5	.8	1.0	.5	.9	.5	.9	2.5
07	.6	.3	.6	1.0	.7	1.0	.9	1.3	1.0	1.3	1.9	1.1	.9	.6	2.8	1.0	2.2	2.8	3.6	2.4	3.0	3.6	4.0	3.1	1.7	4.0
08	2.5	2.1	2.3	2.1	3.0	2.8	3.1	2.5	3.3	3.8	2.2	2.3	2.1	4.2	4.8	4.0	4.8	3.6	2.7	2.4	2.4	1.7	1.6	2.2	2.9	4.8
09	2.0	1.2	.8	.9	1.3	.8	1.1	2.3	3.3	3.3	3.8	5.0	5.9	5.7	7.6	7.6	6.9	2.2	2.9	2.3	2.1	1.8	1.9	1.2	3.1	7.6
10	.2	.8	1.0	.6	.2	.2	.5	.7	.9	1.4	1.9	1.0	1.1	.7	1.2	2.2	1.5	2.2	2.4	2.5	3.5	3.4	3.7	3.6	1.6	3.7
11	3.0	4.3	3.7	3.3	3.4	3.9	4.0	3.7	3.6	4.1	5.0	5.8	5.6	5.4	5.7	5.8	5.7	5.7	5.5	5.3	5.1	6.1	6.1	5.8	4.8	6.1
12	5.6	5.9	6.1	4.9	4.7	3.6	3.1	3.0	2.7	3.5	3.7	3.6	3.2	2.4	1.2	1.3	1.0	1.5	.8	1.2	1.8	1.9	1.7	.5	2.9	6.1
13	1.6	2.0	1.6	1.8	2.2	.6	1.4	1.4	1.2	2.0	1.4	1.4	.9	.9	.9	.9	2.3	2.5	1.8	1.0	1.8	1.3	.3	.2	1.4	2.5
14	.2	.2	.2	.2	.5	.2	.3	.4	.2	.3	.5	1.7	2.7	2.0	1.0	1.0	1.8	2.9	1.3	.2	.2	.2	.2	.2	.8	2.9
15	.2	.2	.2	.3	.2	.2	.2	.3	.7	1.3	3.2	1.6	.8	1.9	2.6	3.3	2.8	.8	1.2	1.3	1.0	.8	.2	.4	1.1	3.3
16	.2	.3	.2	.2	.4	.2	.2	.2	.2	.3	1.0	1.9	1.6	1.9	3.3	2.9	2.7	1.8	.8	.3	.3	.2	.2	.2	.9	3.3
17	.2	.4	.3	.2	.2	.2	.2	.2	.2	.2	.6	.9	1.8	1.9	2.3	3.0	2.8	1.4	.2	.5	.4	.2	.2	.2	.8	3.0
18	.3	.2	.2	.2	.2	.2	.4	.2	.2	.2	1.3	1.6	2.3	3.6	4.8	4.6	3.1	3.6	2.5	2.0	1.5	.8	.2	.8	1.5	4.8
19	.2	.2	.2	.2	.7	.3	.2	.2	.2	.3	.6	.9	1.5	.8	4.5	5.5	5.7	1.9	1.7	1.4	1.4	1.7	1.5	2.6	1.4	5.5
20	7.4	9.3	10.4	9.3	8.2	5.5	6.1	8.2	7.6	4.8	4.6	5.5	5.9	5.4	3.8	3.6	2.5	1.1	1.5	1.5	2.0	1.3	.6	.6	4.8	10.4
21	1.2	1.4	1.1	2.3	1.6	1.6	.2	1.5	.8	.7	1.5	.5	.5	1.1	2.3	3.4	3.8	2.3	.8	1.6	.4	.4	.2	.2	1.2	3.8
22	.2	.2	.2	.2	.2	.2	.6	.5	.2	.9	.9	1.6	1.4	1.5	2.0	2.4	2.2	.2	.3	.9	.2	.2	.2	.2	.7	2.4
23	.2	.2	.2	.2	.4	.2	.2	.2	.2	.2	.2	.3	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.4
24	.2	.2	.2	.2	.2	.3	.2	.2	.2	.3	.2	.4	1.5	3.0	3.2	3.2	3.0	2.3	1.6	.2	1.2	.9	1.0	.4	1.0	3.2
25	.2	.6	1.4	1.5	1.7	.6	.7	.2	.2	.2	1.5	2.1	6.0	6.6	6.1	6.2	5.8	3.8	2.1	2.9	4.6	5.5	4.4	4.4	2.9	6.6
26	4.2	4.9	4.3	3.9	3.5	3.7	5.4	5.3	3.8	3.9	4.2	3.6	2.4	1.5	.8	.3	1.3	1.3	1.3	.8	2.1	1.7	2.9	4.8	3.0	5.4
27	6.1	5.4	3.3	2.8	2.3	.9	.2	.2	.2	.2	.4	.5	.7	.4	.8	1.1	1.4	1.1	1.3	.8	.8	1.0	.4	.6	1.4	6.1
28	.3	.2	.6	.7	.8	1.6	.2	.5	.5	1.3	1.3	.9	.5	.7	.6	2.0	1.3	3.8	1.9	2.7	1.5	1.8	.9	.8	1.1	3.8
29	1.0	.5	.2	.2	2.5	2.2	1.0	1.1	.8	.7	.9	.9	.8	1.0	2.1	3.5	3.6	1.9	.9	2.7	2.8	3.4	2.8	2.8	1.7	3.6
30	2.6	2.6	2.3	2.5	1.1	.2	1.7	1.5	2.3	2.5	3.9	4.2	6.2	5.6	5.8	5.6	5.1	3.1	1.8	2.6	2.8	2.3	1.9	1.7	3.0	6.2
31	1.5	1.1	.7	.2	.5	1.7	1.9	2.2	2.5	2.9	2.4	2.4	3.0	1.4	2.3	1.8	1.5	1.7	1.2	.2	.2	.2	.2	.2	1.4	3.0
	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	NO	
	1.7	1.7	1.6	1.5	1.6	1.3	1.3	1.4	1.4	1.6	2.0	2.3	2.7	2.8	3.2	3.3	3.1	2.3	1.8	1.6	1.7	1.6	1.4	1.4	MEAN	
	7.4	9.3	10.4	9.3	8.2	5.5	6.1	8.2	7.0	5.9	8.3	7.6	8.1	7.0	7.6	7.6	6.9	5.7	5.5	5.3	5.1	6.1	6.1	5.8	MAX	

NUMBER OF TIMES ABOVE MONTANA VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL PRIMARY VALUE: 0
NUMBER OF TIMES ABOVE FEDERAL SECONDARY VALUE: 0

TOTAL NBR READINGS 744
MONTHLY MEAN 1.9
MONTHLY MAX 10.4

FREQUENCY SUMMARY OF UPPER LEVEL WINDS (PERCENTAGES)

LOCATION: FLATHEAD CO - AIRPORT - FLATHEAD STUDY MET

100 METER LEVEL WINDS MORNING SEPTEMBER,1980

DIRECTION	********* WIND SPEEDS METERS/SECOND *********						ROW SUMMARY		
	00.1 TO 02.9	03.0 TO 05.9	06.0 TO 09.9	10.0 TO 15.9	16.0 TO 25.0	GREATER THAN 25.0	TOTAL COUNT	TOTAL PERCENT	AVERAGE SPEED
N			5.5				1	5.5	7.0
NNE	5.5						1	5.5	.5
NE							0	0.0	
ENE		5.5					1	5.5	5.2
E							0	0.0	
ESE	11.1		5.5				3	16.6	3.0
SE			5.5	5.5			2	11.0	8.2
SSE	5.5						1	5.5	2.8
S							0	0.0	
SSW		5.5					1	5.5	5.4
SW							0	0.0	
WSW							0	0.0	
W		5.5					1	5.5	3.7
WNW	5.5	11.1	5.5				4	22.1	5.4
NW							0	0.0	
NNW	5.5	5.5	5.5				3	16.5	5.3
CALM							0	0.0	
COL. TOTALS	33.1	33.1	27.5	5.5			18		4.8

100 METER LEVEL WINDS AFTERNOON SEPTEMBER,1980

DIRECTION	********* WIND SPEEDS METERS/SECOND *********						ROW SUMMARY		
	00.1 TO 02.9	03.0 TO 05.9	06.0 TO 09.9	10.0 TO 15.9	16.0 TO 25.0	GREATER THAN 25.0	TOTAL COUNT	TOTAL PERCENT	AVERAGE SPEED
N							0	0.0	
NNE							0	0.0	
NE							0	0.0	
ENE		11.1					1	11.1	4.1
E	11.1						1	11.1	1.3
ESE							0	0.0	
SE		11.1					1	11.1	3.1
SSE	11.1						1	11.1	2.4
S							0	0.0	
SSW							0	0.0	
SW		11.1					1	11.1	3.4
WSW							0	0.0	
W	22.2	11.1					3	33.3	2.0
WNW	11.1						1	11.1	2.9
NW							0	0.0	
NNW							0	0.0	
CALM							0	0.0	
COL. TOTALS	55.5	44.4					9		2.5

Figure AP-7-J

FLATHEAD COUNTY - AIRPORT - 100 M WINDS - SEPTEMBER 1980

Figure AP-8-J
BILLINGS VO-TECH - TWO HOURS STABILITY ANALYSIS - APRIL 1981
ACOUSTIC RADAR ANALYSIS

BILLINGS-VOTECH (0080-302) MONTH OF APRIL 1981

********** TWO HOUR STABILITY ANALYSIS **********

	HOUR											
DAY	02	04	06	08	10	12	14	16	18	20	22	24
1	E	E	E	D	C	C	C	D	D	D	E	E
2	E	E	E	D	C	C	C	C	D	D	D	E
3	F	E	E	E	D	C	C	C	D	D	E	E
4	E	E	E	D	C	C	C	D	D	D	E	E
5	E	E	E	E	D	C	C	D	D	D	E	D
6	D	D	D	D	D	D	D	D	D	D	D	E
7	F	E	E	E	D	C	C	C	C	D	E	E
8	E	E	E	E	D	C	C	C	C	D	D	E
9	E	E	E	E	D	C	C	C	C	D	D	D
10	D	D	D	D	C	C	C	C	D	D	D	D
11	D	F	F	F	D	C	C	C	D	D	D	E
12	F	F	F	D	C	C	C	C	D	D	D	D
13	E	E	D	C	C	C	C	C	C	D	F	F
14	F	E	E	E	D	C	C	C	D	D	D	F
15	E	E	E	E	D	C	C	C	C	D	D	F
16	E	E	E	D	C	C	D	D	D	D	E	E
17	D	D	D	D	B	B	C	C	D	D	D	F
18	E	E	E	D	C	C	C	C	D	D	E	E
19	D	D	D	C	C	C	C	C	D	D	D	D
20	F	E	E	D	C	C	C	D	D	D	D	D
21	D	D	D	D	C	C	C	D	D	D	D	D
22	D	E	E	C	C	C	C	D	D	D	D	D
23	E	E	E	E	D	C	C	C	C	D	E	E
24	E	E	E	E	D	C	C	C	C	D	E	E
25	E	E	E	D	C	C	C	C	C	D	E	E
26	E	E	E	D	C	C	C	D	D	D	D	D
27	D	D	D	D	C	C	C	C	C	D	E	E
28	E	E	E	D	C	C	C	D	D	D	E	E
29	E	E	D	C	C	C	C	C	D	F	E	E
30	F	F	F	D	C	C	C	C	D	E	F	F

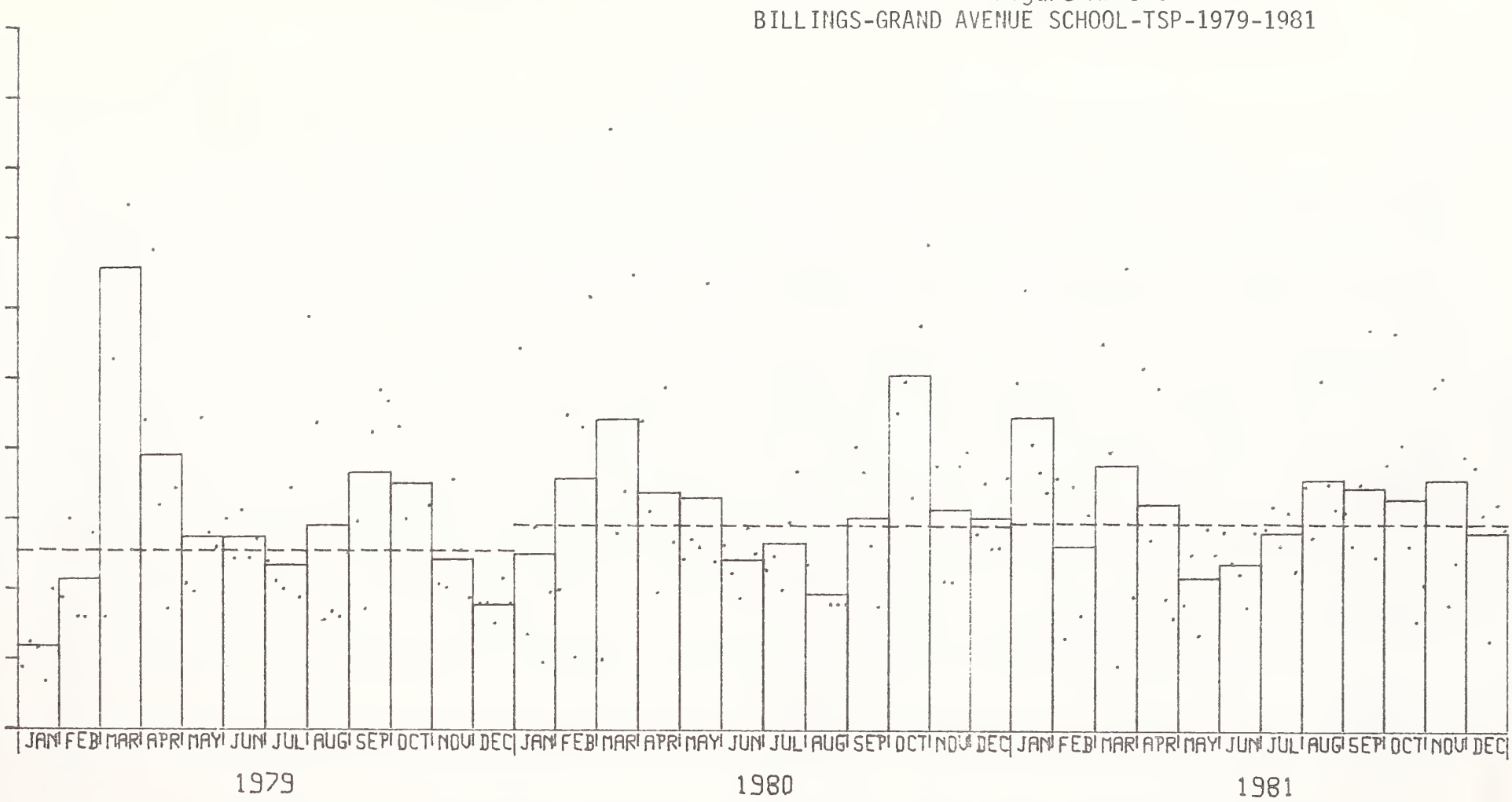
PERCENT FREQUENCY OF OCCURENCE FOR EACH CATEGORY

A= 0.0 % B= 0.6 % C=29.7 % D=37.5 % E=26.4 % F= 5.8 %

U= 0.0 % M= 0.0 %

NOTE: U=UNKNOWN M=MISSING DATA
CLOUD COVER CONDITIONS USED FROM NWS STATION AT BILLINGS
WIND DATA USED FROM NWS STATION AT BILLINGS

Figure AP-9-J
BILLINGS-GRAND AVENUE SCHOOL-TSP-1979-1981



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM OBS	5	5	4	5	5	5	5	6	5	3	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5	6	5	5
MO.AVG	30	54	165	98	69	69	59	73	92	88	61	45	63	90	111	85	83	61	67	49	76	127	79	76	112	66	95	81	55	60	71	90	87	83	90	71
GEO.AVG	64												73												74											

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0080, BILLINGS
SITE. . . . . 009, GRAND AVE SCHOOL
CITY. . . . . BILLINGS

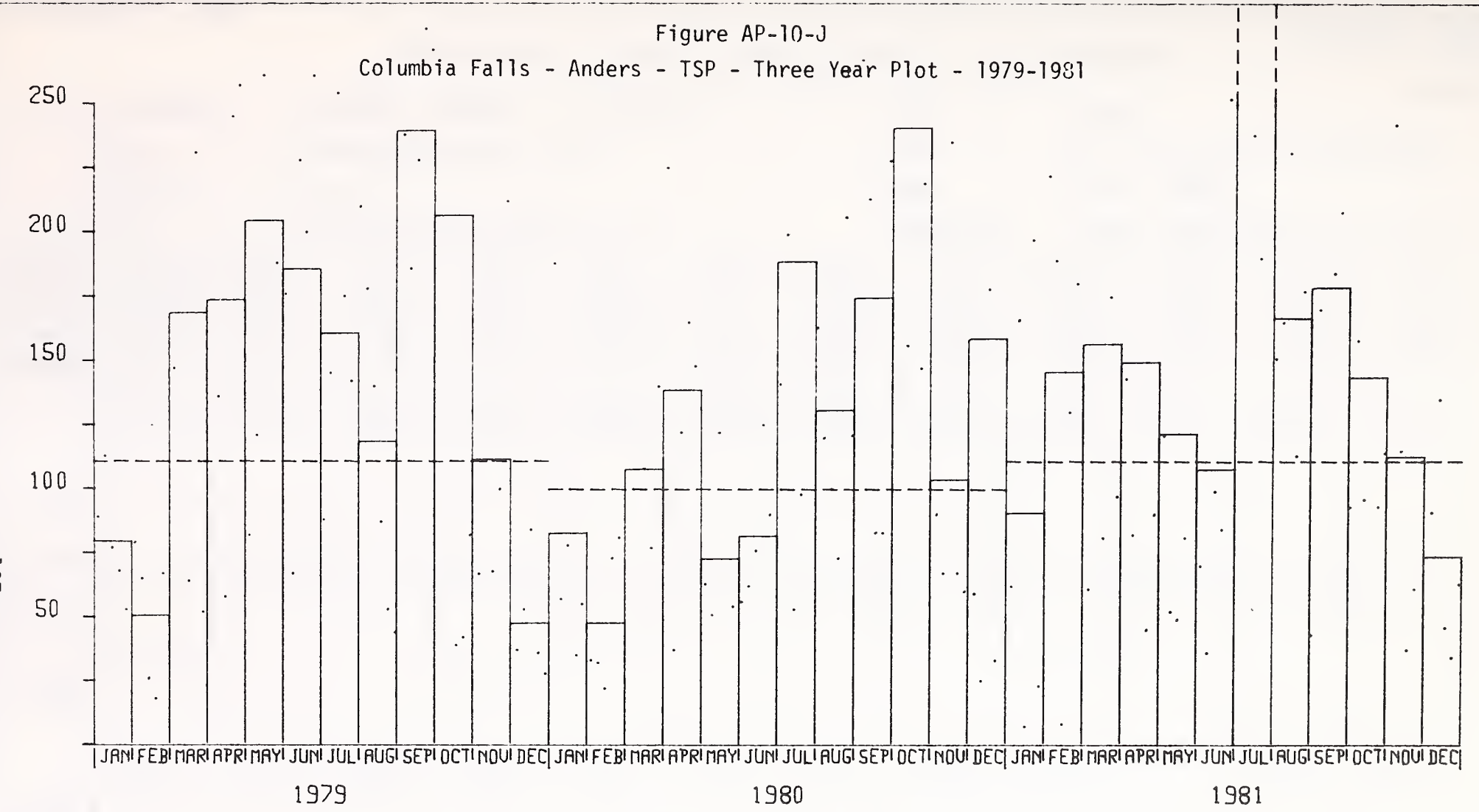
MONTANA STATE AIR QUALITY BUREAU.

SEPTEMBER 13, 1982

TECHNICAL SERVICES

Figure AP-10-J

Columbia Falls - Anders - TSP - Three Year Plot - 1979-1981



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM OBS	5	5	5	4	5	5	5	6	5	5	5	5	5	5	3	5	4	5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	6	5	5
MO.AUG	80	51	169	174	205	186	161	119	240	207	112	48	83	48	108	139	73	82	189	131	175	241	104	159	91	146	157	150	122	108	319	167	179	144	113	74
GEO.AUG	111												100												111											

PLOT. . . . . CONCENTRATION VERSUS TIME

METHOD . . . . . HI VOL

UNITS . . . . . MICROGRAMS/CUBIC METER

STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES

AREA. . . . . 0270, COLUMBIA FALLS

SITE. . . . . 005, ANDERS RESIDENCE

CITY. . . . . COLUMBIA FALLS

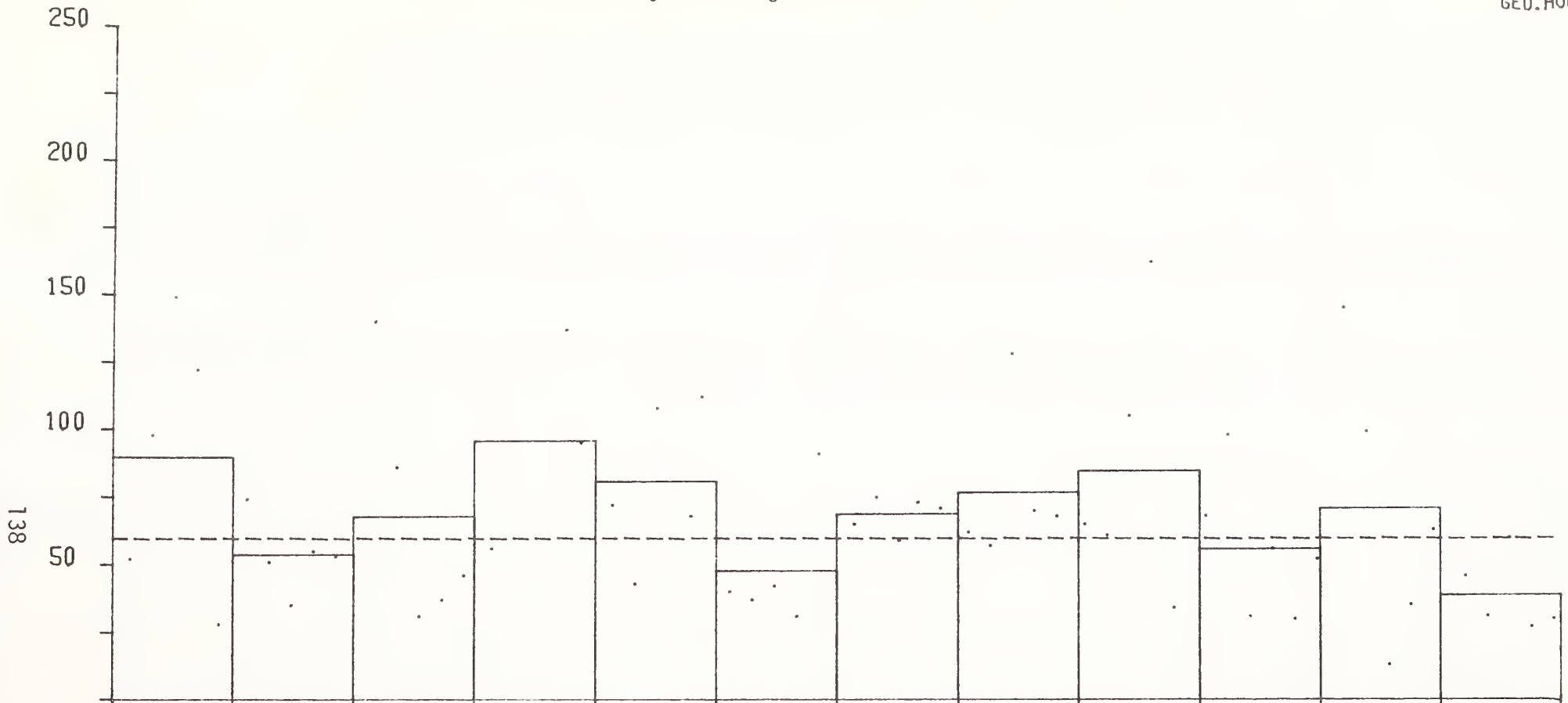
MONTANA STATE AIR QUALITY BUREAU

SEPTEMBER 13, 1982

TECHNICAL SERVICES

Figure AP-11-J
Havre - Central City Building - TSP - One Year Plot - 1981

1981
GEO.AVG = 60



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM-OBS	5	5	5	3	5	5	5	5	5	6	5	5
1-HIGH	149	74	140	137	112	91	75	128	162	98	145	60
2-HIGH	122	55	86	95	108	42	73	70	105	68	99	46
MO.AVG	90	54	68	96	81	48	69	77	85	56	71	39

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0700, HAVRE
SITE. . . . . 001, CENTRAL CITY BUILDING
CITY. . . . . HAVRE

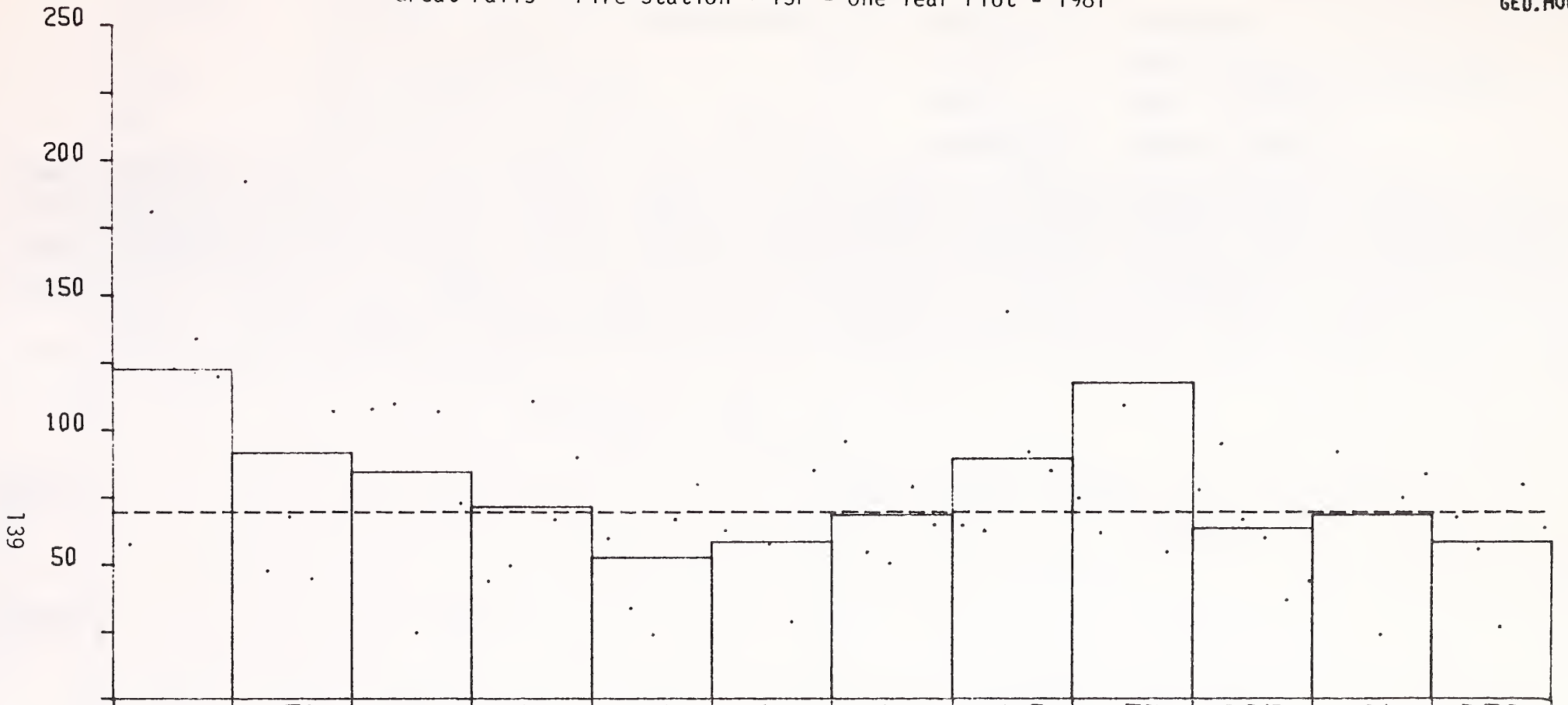
MONTANA STATE AIR QUALITY BUREAU

SEPTEMBER 13, 1982

TECHNICAL SERVICES

Figure AP-12-J
Great Falls - Fire Station - TSP - One Year Plot - 1981

1981
GEO.AVG = 70



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUM-OBS	5	5	5	5	5	4	5	5	5	6	5	5
1-HIGH	181	192	110	111	80	85	96	144	291	95	92	80
2-HIGH	134	107	108	90	67	63	79	92	109	78	84	68
MO.AVG	123	92	85	72	53	59	69	90	118	64	69	59

PLOT. . . . . CONCENTRATION VERSUS TIME
METHOD . . . . . HI VOL
UNITS . . . . . MICROGRAMS/CUBIC METER
STANDARDS . . . (FEDERAL) ANNUAL - 75 UG/CU.M

PARAMETER . . TOTAL SUSPENDED PARTICULATES
AREA. . . . . 0660, GREAT FALLS
SITE. . . . . 009, FIRE STATION
CITY. . . . . GREAT FALLS

MONTANA STATE AIR QUALITY BUREAU

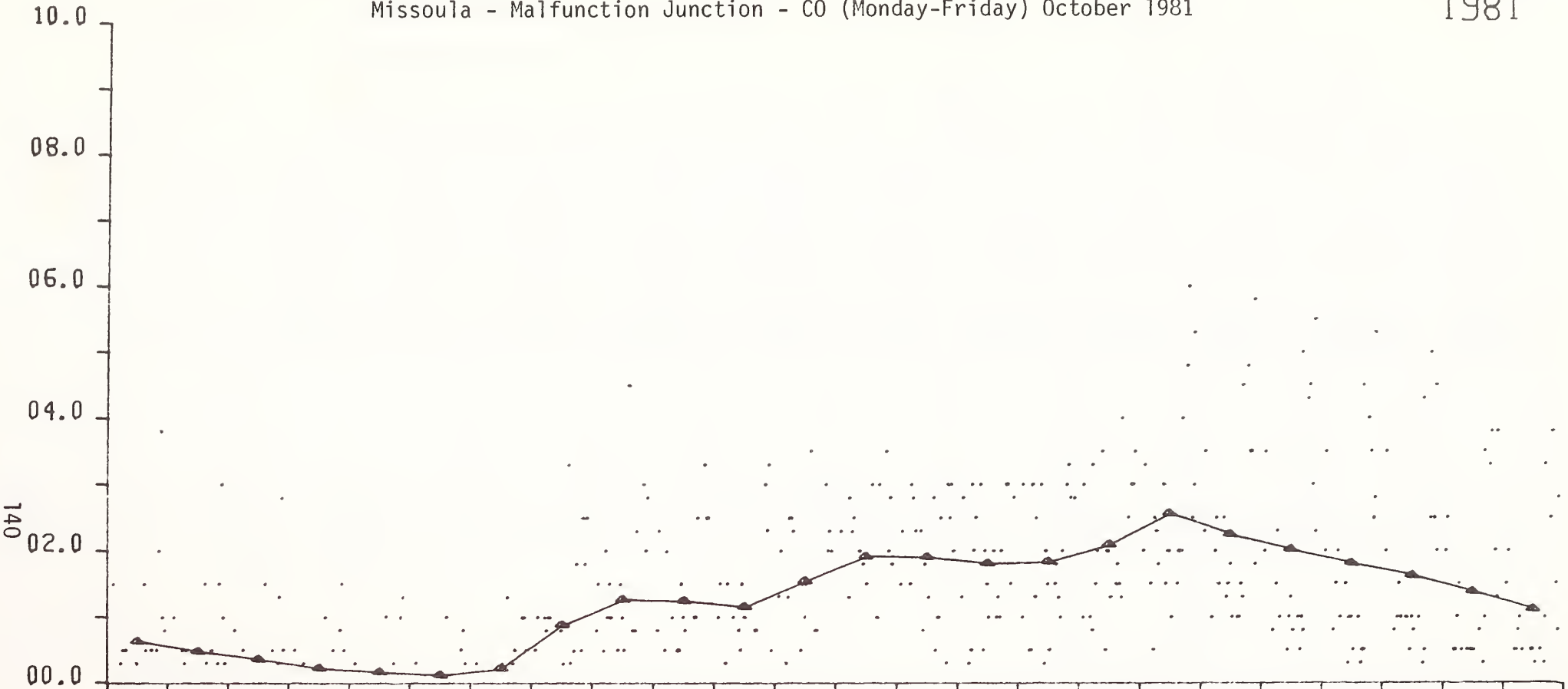
SEPTEMBER 13, 1982

TECHNICAL SERVICES

AP-13-J

Missoula - Malfunction Junction - CO (Monday-Friday) October 1981

OCTOBER
1981



	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
NUM-OBS	22	22	22	22	22	22	22	22	22	19	18	21	18	20	21	21	21	22	22	22	22	22	22	22
1-HIGH	3.80	3.00	2.80	1.50	1.30	1.00	1.30	3.30	4.50	3.30	3.30	3.50	3.50	3.00	3.00	3.30	4.00	6.00	5.80	5.50	5.30	5.00	3.80	3.80
2-HIGH	2.00	1.50	1.50	1.00	1.00	.800	1.00	2.50	3.00	2.50	3.00	3.00	3.00	3.00	3.00	3.00	3.50	5.30	4.80	5.00	4.50	4.50	3.80	3.30
HR.AVG	.645	.486	.373	.232	.177	.132	.236	.891	1.27	1.24	1.15	1.55	1.92	1.91	1.81	1.83	2.09	2.56	2.25	2.02	1.81	1.62	1.37	1.11

PLOT. . . . . CONCENTRATION VERSUS TIME (MON-FRI)

METHOD . . . . . NON-DISPERSIVE INFARED

UNITS . . . . . PARTS PER MILLION

STANDARDS . . . (FEDERAL) 9 PPM 8-HR / 35 PPM 1-HR

PARAMETER . . CARBON MONOXIDE

AREA. . . . . 1080, MISSOULA

SITE. . . . . 005, MALFUNCTION JUNCTION

CITY. . . . . MISSOULA

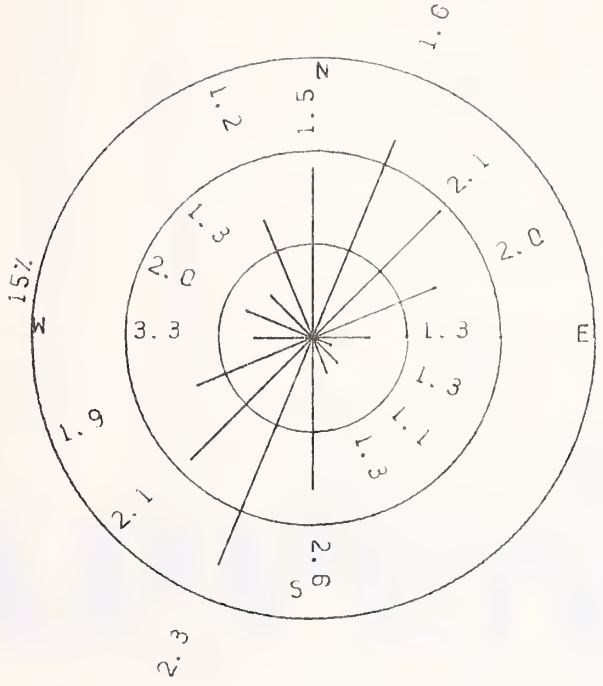
MONTANA STATE AIR QUALITY BUREAU

SEPTEMBER 15, 1982

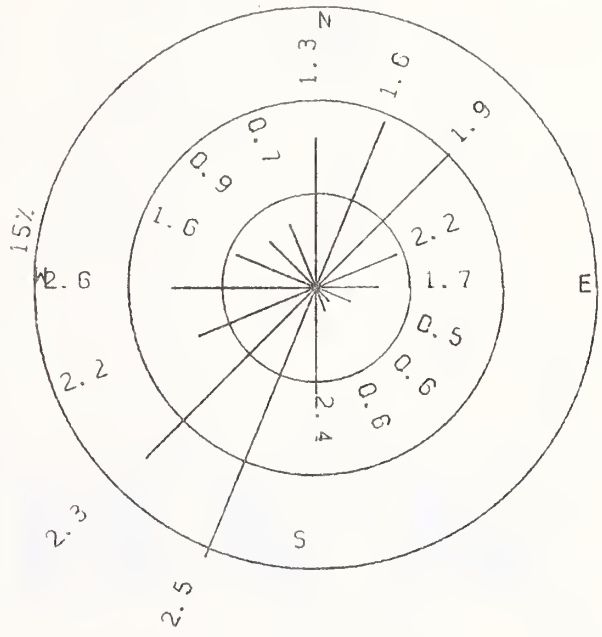
TECHNICAL SERVICES

SURFACE WIND ROSES

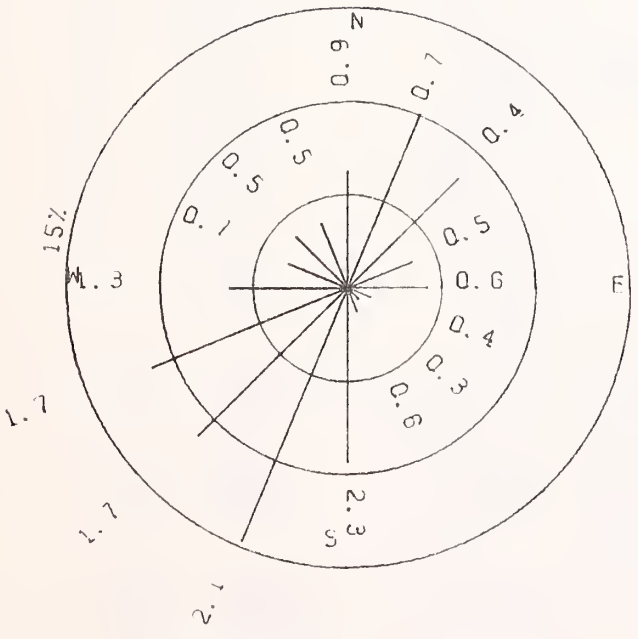
SITE: 480304 GLACIER INTERNATIONAL AIRPORT
KALISPELL MONTANA



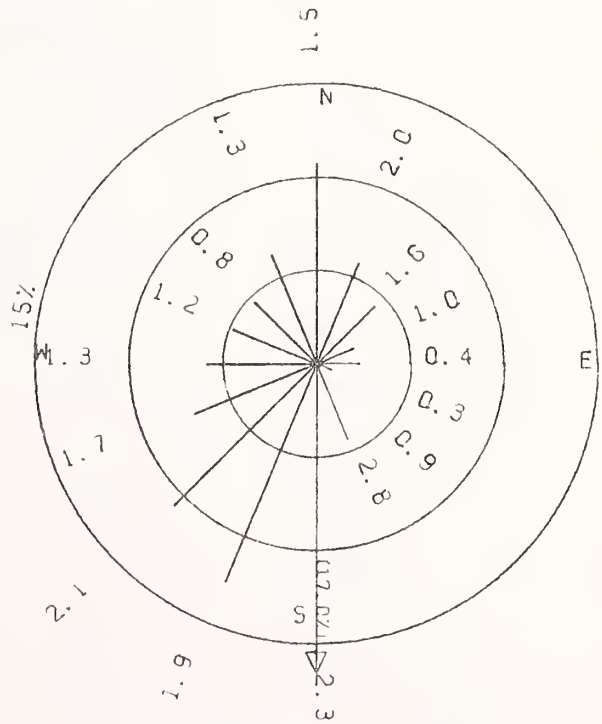
SEPTEMBER 1981
HOURS 0 TO 23
CALM 0.7%
(TOTAL HOURS 715)



OCTOBER 1981
HOURS 0 TO 23
CALM 0.0%
(TOTAL HOURS 744)



NOVEMBER 1981
HOURS 0 TO 23
CALM 0.0%
(TOTAL HOURS 588)



DECEMBER 1981
HOURS 0 TO 23
CALM 0.0%
(TOTAL HOURS 683)

FIGURE AP-14-J

Figure AP-15-J

SAWMILL - EMISSION ESTIMATES WOOD WASTE BURNER

STATE OF MONTANA - DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
POINT SOURCE MASTER DETAIL LIST — REPORT DATE: 05/07/82 — PAGE: 59

COUNTY: BROADWATER 0140 AQCR: HELENA 142 PLANT ID: 0001

SEGMENT ID	YEAR OF RECORD	LAST UPDATE	CONTROL REGION	LOCAL CONTROL	USER PLANT ID	CITY	UTM ZONE	OWNER	CONTACT	TELEPHONE	PRINCIPAL PRODUCT	NUMBER OF EMPLOYEES
000	81	02/82					12	P	DON WOOTEN	4062663111	LUMBER	0012

ESTABLISHMENT NAME AND ADDRESS	ZIP	MAILING ADDRESS	ZIP	PROPERTY AREA - ACRES
			59644	00082.0

SEGMENT ID	YEAR OF RECORD	LAST UPDATE	POINT ID NEDS USER	SIC	IPP	UTM COORDINATES-KM HORIZ	UTM COORDINATES-KM VERT	LATITUDE DEG MIN SEC	LONGITUDE DEG MIN SEC	% ANNUAL THRUPUT DEC MAR	% ANNUAL THRUPUT JUN SEP	NORMAL OPERATING HR/D	NORMAL OPERATING D/WK	NORMAL OPERATING WK/YR
101	81	02/82	01	2421		460.9	5131.6			25 25	25 25	08	1	50

BOILER CAPACITY MM BTU	% SPACE HEAT	STACK DATA HEIGHT FEET	STACK DATA DIAM FEET	STACK DATA TEMP DEG F	STACK DATA FLOW RATE CU FT/MIN	STACK DATA VELOCITY FT/MIN	STACK DATA NBR OF POINTS	STACK DATA PLUME HT FEET	COMPLIANCE STAT	COMPLIANCE SCHED YR MO	COMPLIANCE STAT DATE	ECAP CONTROL REGULATION REG1	REG2	REG3
		0040	20.0	0850	0028690	00092			1			0	1407	

NBR OF POLLUTS	POLLUTANT ID	CONTROL COST THOUS $$	CNTL EQUIP PRI	CNTL EQUIP SEC	% ESTIM CONTROL EFFIENCY	EMISSIONS TONS/YEAR UNCONTROLLED	EMISSIONS TONS/YEAR ESTIMATED	EMISSIONS TONS/YEAR ALLOWABLE	ESTIM METH	TEST METH	EMISS UNITS
05	SUSPENDED PARTICULATE		000		00.0	0000000	0000000		3		
	CARBON MONOXIDE		000		00.0	0000000	0000000		3		
	SULFUR DIOXIDE		000		00.0	0000000	0000000		3		
	NITROGEN DIOXIDE		000		00.0	0000000	0000000		3		
	HYDROCARBON		000		00.0	0000000	0000000		3		

SEGMENT ID	YEAR OF RECORD	LAST UPDATE	SCC I II III IV	FUEL PROCESS RATE	MAX DESIGN RATE-HOURLY	% SULPHUR CONTENT	% ASH CONTENT	HEAT CONTENT MM BTU	CONFID CODE	SOURCE CODE	BEC NBR	FUEL ID	FUEL UNITS
2 01 05	81	02/82	5 03 001 05	000000	0004.600	0.00	5.00	00014	2	C			

SOURCE DESCRIPTION	EMIS FACTOR SOURCE	NBR OF EMIS FACTORS	POLLUTANT ID	EMISSION FACTOR	ASH/SULPHUR CODE	FACTOR UNITS
WOOD WASTE BURNER	A	05	SUSPENDED PARTICULATE	000007.000		
			CARBON MONOXIDE	000130.000		
			SULFUR DIOXIDE	000000.100		
			NITROGEN DIOXIDE	000001.000		
			HYDROCARBON	000011.000		

SEGMENT ID	YEAR OF RECORD	LAST UPDATE	LINE NBR	* * * * COMMENTS * * * *
3 01 10	81	02/82	001	THE OLD SAWMILL TP BURNER IS TOTALLY UNUSEABLE AND HAS BEEN REMOVED FROM THE EIS. ' WILL NOW HAUL
3 01 10	81	02/82	002	CHIPS TO THE NEW RAIL LOADOUT FACILITY IN TOWNSEND, AND SAWDUST DIRECTLY TO MISSOULA. SAWDUST GOES TO
3 01 10	81	02/82	003	A BIN VIA A HIGH PRESSURE SYSTEM WITHOUT A CYCLONE.

SEGMENT ID	YEAR OF RECORD	LAST UPDATE	LINE NBR	* * * * COMMENTS * * * *
3 01 11	81	02/82	001	THIS TP BURNER SERVED THE PLANER MILL UNTIL MAY 1980. IT RECEIVED SHAVINGS AND SAWDUST FROM THE PLAN

APPENDIX K

Smoke Management

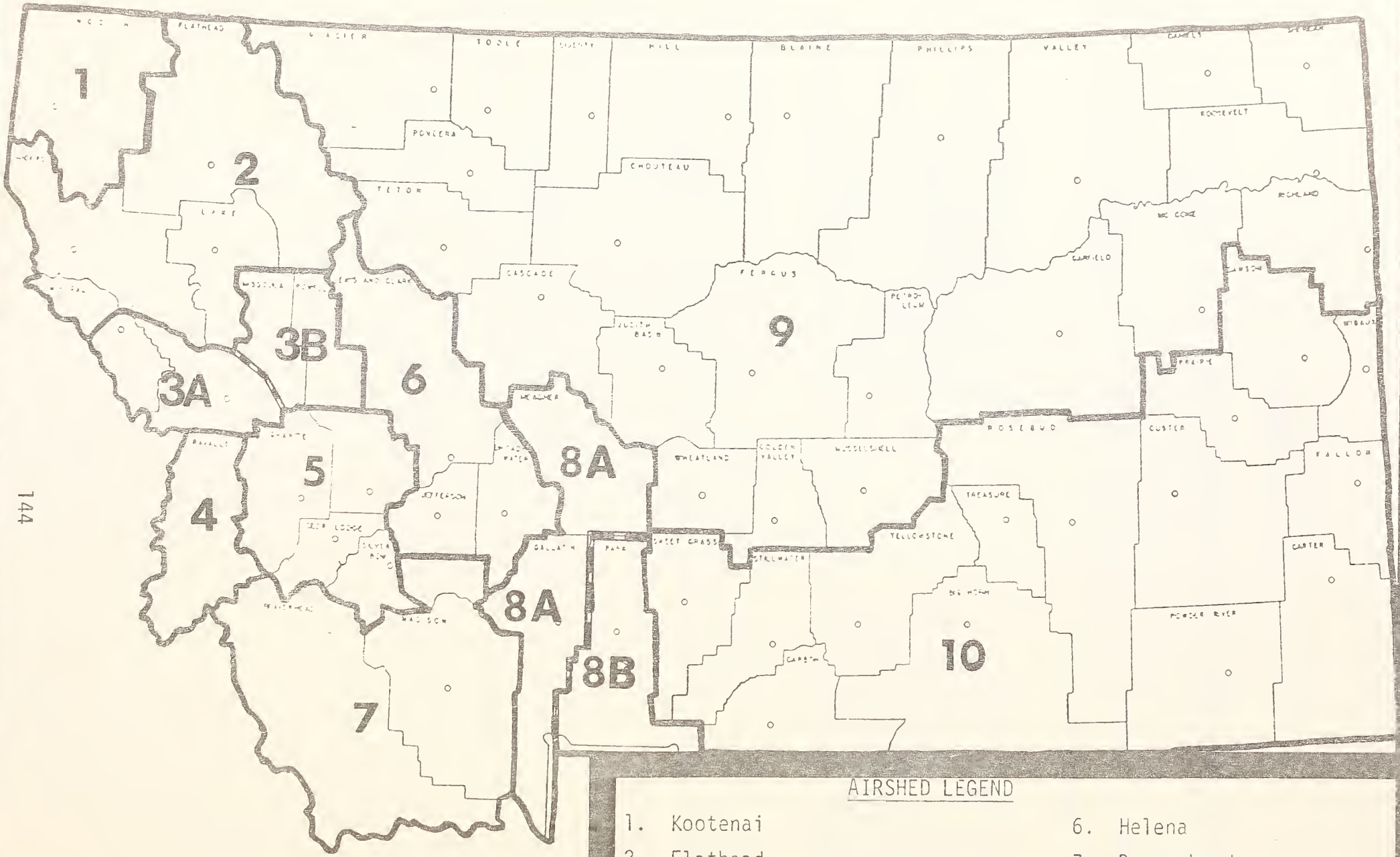
APPENDIX K

SMOKE MANAGEMENT

The Smoke Management Plan was devised by the State Airshed Group to coordinate burning operations on all forest and rangeland in the state. The State Airshed Group consists of representatives from the following agencies and forest products industries.

Air Quality Bureau
U. S. Forest Service
Bureau of Land Management
St. Regis Paper Company
National Weather Service
Glacier National Park
Yellowstone National Park
Missoula City-County Air Pollution Control Board
Bureau of Indian Affairs
Montana Division of Forestry
Burlington Northern, Inc.
Champion International
Mont. Dept. of Fish, Wildlife & Parks
Wicks Forest Industries
U. S. Dept. of Fish and Wildlife

During the autumn months, a two-man monitoring unit is set up at the Montana Division of Forestry Office in Missoula. This unit gathers meteorological information daily and has the authority to issue burning restrictions on days forecast for poor ventilation. Restrictions are issued only for those areas predicted to experience inversions or poor dispersion. The map on the following page (Figure AP-1-K) shows the ten designated airsheds in Montana. The success of this plan involves the cooperative effort of all organizations involved in the use of prescribed burning for disposal of slash and other accepted land management practices.



AIRSHED LEGEND

1. Kootenai
2. Flathead
3. A. Clark Fork B. Blackfoot
4. Bitterroot
5. Upper Clark Fork
6. Helena
7. Beaverhead
8. A. Gallatin
   B. Park
9. Missouri
10. Yellowstone

Figure AP-1-K

MONTANA SMOKE MANAGEMENT AIRSHEDS

APPENDIX L

Hi-vol Schedules

Figure AP-1-L

1982

1982 SAMPLING SCHEDULE
(Every 6th Day)

QUARTER 1

January -	February -	March -
5	4	6
11	10	12
17	16	18
23	22	24
29	28	30

QUARTER 2

April -	May -	June -
5	5	4
11	11	10
17	17	16
23	23	22
29	29	28

QUARTER 3

July -	August -	Sept. -
4	3	2
10	9	8
16	15	14
22	21	20
28	27	26

QUARTER 4

October -	November -	December
2	1	1
8	7	7
14	13	13
20	19	19
26	25	25
		31

January - (1983)
6
12
18
24
30

NOTE: The sampler should start at midnight, run for 24 hours on the date shown, and be stopped at midnight.

Figure AP-2-L

1983

1983 SAMPLING SCHEDULE
(Every 6th Day)

QUARTER 1

January -	February -	March -
6	5	1
12	11	7
18	17	13
24	23	19
30		25
		31

QUARTER 2

April -	May -	June -
6	6	5
12	12	11
18	18	17
24	24	23
30	30	29

QUARTER 3

July -	August -	Sept. -
5	4	3
11	10	9
17	16	15
23	22	21
29	28	27

QUARTER 4

October -	November -	Dec. -
3	2	2
9	8	8
15	14	14
21	20	20
27	26	26

January - (1984)
1
7
13
19
25
31

NOTE: The sampler should start at midnight, run for 24 hours on the date shown, and be stopped at midnight.

APPENDIX M

List of Air Quality Rules

APPENDIX M

LIST OF AIR QUALITY RULES

This appendix provides a list of the Montana Air Quality Rules. As mandated by the Clean Air Act of Montana, the Board of Health and Environmental Sciences adopted the rules through a review and hearings procedure. It is the Department's business to administer and enforce the rules. Upon request, a copy of these rules can be obtained from the Air Quality Bureau.

HEALTH AND ENVIRONMENTAL SCIENCES

CHAPTER 8

AIR QUALITY

Sub-Chapter 1

Variance Procedures

Rule 16.8.101 Initial Application
16.8.102 Renewal Application

Sub-Chapter 2

Enforcement Procedures

Rule 16.8.201 Notice of Violation - Order to Take Corrective Action
16.8.202 Appeal to Board

Sub-Chapter 3

Rehearing Procedures

Rule 16.8.301 Standing
16.8.302 Form and Filing of Petition
16.8.303 Filing Requirements
16.8.304 Board Review

Sub-Chapter 4

Emergency Procedures

Rule 16.8.401 Conditions
16.8.402 Orders Required
16.8.403 Notice of Hearing - Service
16.8.404 Hearing

Sub-Chapter 5

Ambient Air Quality Standard Rule Procedures

Rule 16.8.501 Procedures for Hearings on Proposed Ambient Air Quality Standards

Sub-Chapter 6, reserved

Sub-Chapter 7

General Provisions

Rule 16.8.701 Definitions
Rules 16.8.702 and 16.8.703, reserved
16.8.704 Testing Requirements
Rule 16.8.705 reserved
16.8.706 Malfunctions
16.8.707 Circumvention

Sub-Chapter 8

Ambient Air Quality

Rule	16.8.801	Board Policy
		Rule 16.8.802 reserved
	16.8.803	Standards
	16.8.804	Sampling and Analytical Procedures
	16.8.805	Purpose
	16.8.806	Definitions
		Rule 16.8.807 reserved
	16.8.808	Enforceability
	16.8.809	Methods and Data
		Rule 16.8.810 reserved
	16.8.811	Ambient Air Quality Standards for Carbon Monoxide
		Rule 16.8.812 reserved
	16.8.813	Fluoride in Forage
	16.8.814	Ambient Air Quality Standards for Hydrogen Sulfide
	16.8.815	Ambient Air Quality Standards for Lead
	16.8.816	Ambient Air Quality Standards for Nitrogen Dioxide
	16.8.817	Ambient Air Quality Standards for Ozone
	16.8.818	Ambient Air Quality Standards for Settled Particulate Matter
		Rule 16.8.819 reserved
	16.8.820	Ambient Air Quality Standards for Sulfur Dioxide
	16.8.821	Ambient Air Quality Standards for Total Suspended Particulate Matter
	16.8.22	Ambient Air Quality Standards for Visibility

Sub-Chapter 9

Prevention of Significant Deterioriation

Rule	16.8.901	Definitions
	16.8.902	Redesignation
		Rule 16.8.903 reserved
	16.8.904	Ambient Air Increments
	16.8.905	Ambient Air Limits
	16.8.906	Restrictions on Area Classifications
	16.8.907	Exclusions from Increment Consumption
		Rule 16.8.908 reserved
	16.8.909	Review of Major Stationary Sources and Major Modifications
	16.8.910	Control Technology Review
	16.8.911	Air Quality Review
	16.8.912	Monitoring
	16.8.913	Additional Impact Analyses
		Rule 16.8.914 reserved
	16.8.915	Exemptions from Impact Analysis
	16.8.916	Air Quality Models
	16.8.917	Stack Heights and Dispersion Techniques
	16.8.918	Source Information
		Rule 16.8.919 reserved
	16.8.920	Sources Impacting Federal Class I Area - Additional Requirements

Sub-Chapter 10 reserved

Sub-Chapter 11

Permit, Construction and Operation of Air Contaminant Source

Rule 16.8.1101 Definitions
16.8.1102 When Permit Required - Exclusions
16.8.1103 Emission Control Requirements
16.8.1104 Existing Sources and Stacks - Permit Application Requirements
16.8.1105 New or Altered Sources and Stacks - Permit Application Requirements
Rule 16.8.1106 reserved
16.8.1107 Public Review of Permit Application
Rule 16.8.1108 reserved
16.8.1109 Conditions for Issuance of Permit
16.8.1110 Denial of Permit
16.8.1111 Duration of Permit
16.8.1112 Revocation of Permit
16.8.1113 Modification of Permit
16.8.1114 Transfer of Permit
16.8.1115 Inspection of Permit
Rule 16.8.1116 reserved
16.8.1117 Compliance with other Statutes and Rules
16.8.1118 Waivers

Sub-Chapter 12

Stack Heights

Rule 16.8.1201 Definitions
16.8.1202 Requirements
16.8.1203 Exceptions

Sub-Chapter 13

Open Burning

Rule 16.8.1301 Definitions
16.8.1302 Prohibited Open Burning
16.8.1303 Minor Open Burning Source Requirements
16.8.1304 Major Open Burning Source Restrictions
16.8.1305 Special Burning Periods
16.8.1306 Firefighter Training
16.8.1307 Conditional Air Quality Open Burning Permits
16.8.1308 Emergency Open Burning Permits

Sub-Chapter 14

Emissions Standards

Rule	16.8.1401	Particulate Matter, Airborne
	16.8.1402	Particulate Matter, Fuel Burning Equipment
	16.8.1403	Particulate Matter, Industrial processes
	16.8.1404	Visible Air Contaminants
	16.8.1405	Open Burning Restrictions (repealed)
	16.8.1406	Incinerators
	16.8.1407	Wood-Waste Burners
		Rules 16.8.1408 through 16.8.1410 reserved
	16.8.1411	Sulfur Oxide Emissions - Sulfur in Fuel
	16.8.1412	Sulfur Oxide Emissions - Primary Copper Smelters
	16.8.1413	Sulfur Emissions - Kraft Pulp Mills
	16.8.1414	Sulfur Oxide Emissions - Lead or Lead-Zinc Smelting Facilities
		Rules 16.8.1415 through 16.8.1418 reserved
	16.8.1419	Fluoride Emissions - Phosphate Processing
	16.8.1420	Fluoride and Particulate Emissions - Aluminum Plants
		Rules 16.8.1421 through 16.8.1422 reserved
	16.8.1423	Standard of Performance for New Stationary Sources
	16.8.1424	Emission Standards for Hazardous Air Pollutants
	16.8.1425	Hydrocarbon Emissions - Petroleum Products
	16.8.1426	Motor Vehicles
	16.8.1427	Odors

Sub-Chapter 15

Emission Standards for Existing Aluminum Plants

Rule	16.8.1501	Definitions
	16.8.1502	Standards for Fluoride
	16.8.1503	Standard for Visible Emissions
	16.8.1504	Monitoring and Reporting
	16.8.1505	Startup and Shutdown

APPENDIX N

Visible Emission Documentation

APPENDIX N

VISIBLE EMISSION DOCUMENTATION

Visible emission documentation on a pollution source is performed by a trained observer in the field. A pollution source may be a tepee burner, asphalt plant, boiler, power plant or any stack or emission point that might exhibit a plume.

Visible emissions are taken by the observer in five percent increments of opacity. Opacity is defined as the degree, expressed in percent, to which emissions reduce the transmission of light and obscure the view of an object in the background.

All point sources have opacity limitations. These are listed in the air quality rules. The opacity standards range from 10 to 40 percent and depend on the type and age of the source.

In order for a person to become a trained observer, he or she must attend a visible emissions documentation course or "smoke school." The Air Quality Bureau offers a smoke school twice each year, usually in April and October. The observer must attend a lecture session and pass a field session in order to pass smoke school.

The lecture section includes the following topics:

Definition of opacity

Composition of Plumes

Meteorological aspect of Plumes

Smoke Generator

Method 9 Certification Procedures and Field Documentation

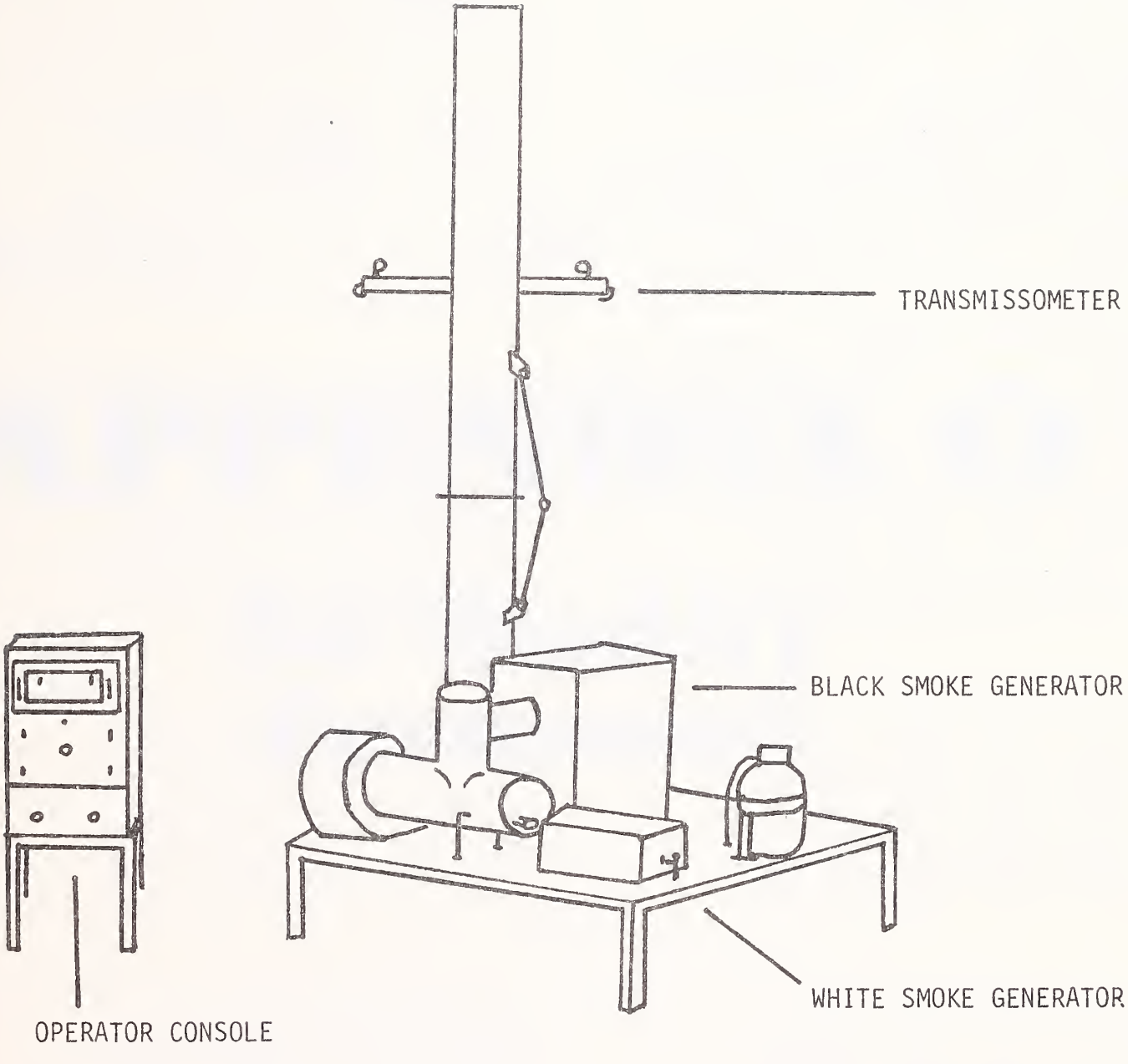
Opacity Regulations

Legal Aspects of Opacity

During the field portion, the observer reads the opacity of 25 black and 25 white smoke plumes produced by a smoke generator. Observed opacities are compared with measured opacities (transmissometer readings) and a certain degree of accuracy is needed to pass.

After a person passes smoke school, the qualified observer can read opacity of a plume in the field. A plume must be read for six minutes, taking 24 readings every 15 seconds. Care must be taken not to read a steam plume if one exists.

A drawing of the smoke generator (Figure AP-1-N) and a visible emission documentation form (Figure AP-2-N) are copied on the following pages.



ENVIRONMENTAL INDUSTRIES

MODEL 3000

SMOKE GENERATOR

Figure AP-1-N

MONTANA STATE DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY BUREAU

VISIBLE EMISSIONS FIELD DOCUMENTATION

FIRM NAME _____ DATE _____
ADDRESS _____ START TIME _____
BUSINESS _____ STOP TIME _____
DESCRIPTION OF SOURCE _____ OBSERVER _____
_____ OBSERVATION POINT _____
TYPE OF FUEL _____ _____
STACK HEIGHT _____ STACK DIAMETER _____ _____
DISTANCE FROM STACK _____ ☐ RESPONSE TO COMPLAINT
DIRECTION FROM STACK _____ ☐ ROUTINE INSPECTION
GENERAL PLUME CHARACTERISTICS (COLOR, ETC.) ☐ OBSERVATION
_____ ☐ SPECIAL INVESTIGATION
GENERAL METEOROLOGY: SKY CONDITIONS AND COLOR _____ EST. AMBIENT
AIR TEMP. _____ EST. WIND SPEED _____ DIRECTION _____ EST. RELATIVE HUMIDITY _____

PLUME DENSITY READINGS: IN OPACITY

MIN \ SEC	0	15	30	45	REMARKS
0					
1					
2					
3					
4					
5					

MIN \ SEC	0	15	30	45	REMARKS
0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

0					
1					
2					
3					
4					
5					

OTHER REMARKS _____

AVERAGE PLUME DENSITY OPACITY _____ TOTAL MINUTES IN VIOLATION _____

IF VIOLATION NOTED, PERSON CONTACTED _____ DATE _____ TIME _____

Figure AP-2-N

VISIBLE EMISSION DOCUMENTATION FORM

APPENDIX O

Air Quality Personnel

APPENDIX O

AIR QUALITY PERSONNEL
1981

Air Quality Bureau

(406)449-3454

Harold Robbins, Chief (1980-present)
Dean Arthun
John Coefield
*Henry Custin
Patricia Davidson
Pat Driscoll
Charles Homer
Jim Hughes
Harry Keltz
David Maughan
Jackley Meyers
Warren Norton
Jim Olsen
Jerry Preszler
Bob Raisch
Jerry Schneider
Stan Sternberg
Maureen Stohl
Cynthia Wevers

Cascade County Air Pollution Control

(406)761-1190

William Neilsen
Bruce Treis

Missoula City-County Health Department

(406)721-5700

Jim Carlson
Scott Church
Bob Jeffreys

Yellowstone County Air Pollution Control

(406)252-0756

Steve Duganz
Russ Boschee

*No longer employed by the Air Quality Bureau

APPENDIX P

Air Monitoring Equipment

APPENDIX P

Air Monitoring Equipment

This appendix is intended to give the data and information user a brief description of how air monitoring equipment works. Most of the information contained in this appendix was taken from the Air Quality Bureau's Quality Assurance Handbook.

Table AP-P-I gives a summary of the various pollutants and their analytical procedure.

Table AP-P-I

Pollutants and Analytical Procedures

Analyte	Procedure
Total Suspended Particulate	Filter Impaction/Gravimetric Analysis
Respirable Particulates	Operation/Dichotomous or Virtual Sampler
Particulates	Beta Attenuation
Carbon Monoxide	Non-dispersive Infrared
Lead	Atomic Absorption Spectrophotometry
Hydrogen sulfide and sulfur dioxide	Gas chromatography and flame photometric detection
Sulfur Dioxide	Pulsed fluorescence
Nitrogen oxides	Chemiluminescence
Ozone	Ultraviolet photometry
Hydrocarbons	Flame Ionization
Gaseous and particulate fluorides	Bicarbonate tube
Fluoride	Dual tape sampler
Foliar Fluoride	Colorimetric Method

Analyte: Total Suspended Particulates (TSP)

Procedure: Filter impaction/gravimetric analysis

General Information:

Particulate matter is collected by a high volume sampler (hi-vol) by pulling a known volume of air through a preweighed glass fibre filter. As the air is pulled through the filter, particulate matter that is suspended in the air is impacted onto the filter material. After the sampler has run for 24 hours, the filter is reweighed (usually in a laboratory). The weight of the particulate matter (grams) on the filter is divided by the volume of air (cubic meters (m^3)) to give a concentration in micrograms per cubic meter (ug/m^3).

The hi-vol is constructed of aluminum in the shape of a box (dimensions 16" x 16" x 48") with a pitched roof. The interior contains a "vacuum cleaner" type electric motor, a filter holder, a flow measuring device(s), and a timer. The samplers usually run on a one-in-six day schedule but may be run more frequently if necessary.

A laboratory type balance is used to weigh the filter. The balance needs to be accurate to one tenth of a milligram (0.1 mg) or one ten thousandth of a gram. There are 453.6 grams in a pound.

Analyte: Particulates

Procedures: Beta attenuation

General Information:

This analyzer measures concentrations of airborne particulates, integrated over preprogrammed time intervals, by the process of beta ray attenuation. Samples are collected on strips of glass fiber tape. Before the sample is collected, the tape is positioned between a beta ray source (C^{14}) and a geiger counter. The beta ray count taken through the tape is used as a blank value. Sample is deposited on the tape by a constant flow of ambient air. The sample and tape are again situated between the source and counter. This second count will be lower than the first count because the sample will absorb some of the beta rays in excess to the amount of x-rays absorbed by the tape itself. The difference in beta ray counts between the tape and the tape plus sample is log proportional to the amount of sample on the tape. After calculating, the sample mass, it is divided by the total airflow over the sample collection period. This gives an integrated particulate concentration for that sample period. All calculations are done internally by the analyzer with a microprocessor. Sample times as low as 3 minutes or as great as 999 minutes can be programmed by the user.

Analyte: Respirable and Inhalable Particulates

Procedure: Operation, Dichotomous or Virtual Impactor

General Information:

The dichotmous sampler is designed to sample for particulates of two size ranges: 1) those particles less than 2.5 microns (aerodynamic diameter), and 2) those particles greater than 2.5 microns and less than 15 microns. Two 37 millimeter diameter filters collect the particulate, one filter for each size range. The filters are weighed before and after each run to determine the mass loading on each filter. Concentration is then calculated if the air flow is known for each filter. Two rotometers are installed on the sampler to measure the flow during the run.

This type of instrument is divided into two sections: the sampling module and the control module. The sampling module contains the sampling head separation device, and the two filters. The control module contains the air pump, flow controller, rotameters, and the clock mechanism. The two units are connected by polypropylene tubing.

The sampling module is the portion where the actual separation and collection of each particle size is accommplished. The particles larger than 15 microns are eliminated at the round sampling head. A bug screen is placed in the sampling head to keep out insects and to collect particles larger than 15 microns. The particles less than 15 microns proceed down the sampling tube to the nozzle. The nozzle accelerates the particles and forces the majority of air (approximately 90%) to make a sharp 90° turn in a very short distance. This 90° turn is the principle on which the separation is based. Any heavy particle (i.e. any particle greater than 2.5 microns) will not be able to make this sudden turn. These particles will be drawn down into the coarse particles tube which is located straight below the nozzle. The other particles (less than 2.5 microns) will make the 90° turn and will be drawn down the fine particle tube. At the bottom of both tubes are the appropriate filters. The air flow is drawn from the control module through the 3/8" and 1/4" lines.

Analyte: Lead

Procedure: Atomic Absorption Spectrophotometry

General Information

Lead is sampled in the field using a standard hi-volume air sampler. This sampler pulls a large volume of air through a glass fiber filter. The filter is then normally mailed from the field site to the Air Quality Bureau where the sample is logged in. The volume of the air sample is calculated and then it is transferred to the laboratory for analysis. The filter is equilabrated and weighed for total suspended particulate. Then the filter must be extracted using an acidic solution to solubilize the lead on the filter. The resulting solution is analyzed using atomic absorption spectrophotometry to determine the amount of lead present.

Analyte: Sulfur Dioxide

Procedures: Pulsed fluorescence

General Information

The sample airstream is exposed to a pulsating ultraviolet light, which electromagnetically excites sulfur dioxide in the air sample. The excited SO_2 quickly decays to its ground state emitting a photon of fluorescent light, whose intensity is measured by a photomultiplier tube. The wavelength of excitation light entering the detection chamber and the wavelength of fluorescent light entering the photomultiplier tube both are carefully controlled by narrow bandpass filters, which reduce interference from other fluorescent species in the sample gas. The light is pulsed for six reasons: long UV lamp life, high intensity UV without lamp heating, small lamp size for UV output, low lamp power requirements, long term UV stability, and chopped signal processing (alternatively measuring signal and photomultiplier dark current). After the photomultiplier dark current is subtracted from the fluorescent SO_2 signal, the signal output is directly proportional to the concentration of SO_2 in the sample gas.

Analyte: Hydrogen sulfide and sulfur dioxide

Procedures: Gas chromatography and flame photometric detection

General Information:

Ambient air entering the analyzer is separated into two fragments by a gas chromatographic column, one part containing any sulfur dioxide present in the sample and the second component consisting of any hydrogen sulfide. The amount of sulfur atoms in each fragment is detected by a flame photometer. This detection principle consists of burning the sample in a hydrogen rich flame, which produces the excited reduced species S_2. The S_2 decays to ground state emitting a photon near 390nm. This photon is sensed by a photomultiplier tube. Because the measured molecule is a sulfur dimer, the photomultiplier output (picoamps) is nonlinear with respect to ambient sulfur concentrations. The output is approximately to the 1.8 power of the ambient concentration. Deviation from the theoretical second power is due to quenching of the excited species. The photomultiplier output is linearized by a set of logarithmeic amplifiers. The rest of the analyzer consists of flow control devices and temperature controllers for the detector oven and column.

Analyte: Nitrogen Oxides

Procedures: Chemiluminescent reaction of NO and O_3

General Information:

The analyzer utilizes a chemiluminescent reaction between nitric oxide and ozone to quantitatively determine the concentration of nitrogen oxides in the sample air. Ozone, produced in excess by ultraviolet irradiation of dried air, is reacted with any nitric oxide in the sample air and the resultant chemiluminescent photons are measured with a photomultiplier proportional to the amount of nitric oxide in the sample. A second portion of sample air is routed through a converter which changes all the NO_2 in the sample air to nitric oxide. This gas is reacted in another reaction chamber with the ozone and gives a measurement proportional to the total amount of nitrogen oxides in the sample. Thus, there are two parallel reaction chambers determining the nitric oxide concentration and the total nitrogen oxides concentration. These signals are electronically subtracted to give a nitrogen dioxide concentration.

Analyte: Ozone

Procedures: Ultraviolet photometry

General Information:

This analyzer works on the principle of absorption of ultraviolet light in the 254nm band by ozone. The principle is similar to an ultraviolet spectrophotometer with a 71cm folded gas cell. A sample of ambient air, selectively scrubbed of ozone, is injected into the cell. The attenuation of ultraviolet light without ozone is determined by a light sensitive diode. The sample cell is flushed and a new sample of air containing ambient levels of ozone is measured for ultraviolet absorption. The sample air without ozone is a reference cell measurement. The difference between the reference measurement and the sample with ozone measurement determines the ultraviolet absorption attributable only to the ozone. This absorption is proportional to the ozone concentration by the Beer-Lambert law. Since only a single detection cell is used in the instrument, ambient air and ozone-scrubbed ambient air are sequentially cycled through the cell. This cycle time is between 20 and 30 seconds. This means that the analyzer will not give correct values in situations in which the ozone concentration changes significantly in 30 seconds. This usually does not present a problem in enforcement monitoring but may be significant in low level research near point sources.

Analyte: Carbon Monoxide

Procedures: Non-dispersive Infrared

General Information:

The (carbon monoxide) analyzer measures continuous amounts of carbon monoxide from 0-50 to 0-1000 ppm full scale deflection. The detector operates on an infrared absorption principle.

The analyzer detects carbon monoxide from the absorption of infrared radiation. Nondispersive infrared radiation is introduced to the detector with a double-beam arrangement. The infrared beams pass through two cells: (1) a sealed reference cell filled with a non-absorbing gas, and (2) a sample cell through which the sample air containing the carbon monoxide is continuously drawn.

The Infrared Gas Analyzer utilizes the measurement principle based on CO having a known characteristic absorption spectra in the infrared range. The analyzer contains an infrared detector that uses the nondispersive single beam technique with alternate modulation of the sample and reference cells. The reference cell is filled with a nonabsorbing gas and sealed, and the sample is routed through the sample cell. With no CO present in the sample, the amounts of radiation coupled into the detector from the sample and reference cells will be essentially equal, effectively canceling in the detector and producing no output. When CO is present in the sample, some radiation is absorbed by the CO, causing the detector inputs to be unequal, and producing a capacitance change in the detector. The detector is so designed that the amount of capacitance change in the detector is equivalent to a known amount of CO. The infrared radiation is chopped by an optical chopper to cause a periodic capacitance change, which modulates a radio frequency signal from an oscillator. This signal is subsequently demodulated, amplified, and the output is fed to the front panel meter as well as to a strip chart recorder.

Analyte: Reactive Hydrocarbons

Procedures: Flame Ionization

General Information:

The hydrocarbon analyzer measures semicontinuous amounts of total hydrocarbons (THC) and non-methane hydrocarbons (NMH) simultaneously from a 0 to 10 ppm to a 0 to 50 ppm full scale deflection. At the same time the instrument measures semicontinuous amounts of methane from a 0 to 2 ppm to a 0 to 10 ppm full scale deflection. The detector operates on a flame ionization principle.

Measured volumes of air are delivered semi-continuously (18 times per hour) to a hydrogen flame (the detector area). Basically, the detector area consists of a burner (jet), a collector (an electrical plate), and an oxygen rich atmosphere with a supply of hydrogen to keep a small flame. Any hydrocarbons present in the sample will be burned causing an electrical current flow from the burner tip to the collector by way of the flame. The amount of current flow (ionization) is proportinal to the concentration of the hydrocarbons. The electrical signal is amplified to give a meter and a recorder output for total hydrocarbons. An aliquot of the same air sample is introduced into a stripper column which removes water, carbon dioxide, and hydrocarbons other than methane (gas chromatograph principle). The methane is then introduced to the detector where the response is recorded. The methane value is electronically subtracted from the total hydrocarbon value to obtain the reactive hydrocarbon or the non-methane value.

Control and division of the sample is accomplished by a flow system consisting of an air supply, solenoid valves, and switching valves. Flow rates and overall timing mechanisms must be precisely controlled in the analyzer.

The response to all three variables may be monitored simultaneously by three recorders or by a single multipoint recorder.

Analyte: Fluoride

Procedures: Dual paper tape collection of HF and particulates

General Information:

Sample air is drawn through the inlet tube and down through two paper tapes. The first tape is treated with citric acid and functions as a collector for particulates. The citric acid prevents the first tape from reacting with and absorbing gaseous hydrogen fluoride. The second tape is treated with sodium hydroxide and recovers better than 95 percent of the hydrogen floride at sampling times of 15 to 120 minutes with fluoride loads up to 40 ug/m^3. The sample air is drawn through a soda lime scrubber which removes the fluorides. The scrubbed air is drawn through a soda lime scrubber which removes the fluorides. The scrubbed air is used to pressurize the cabinet containing the sample tape rolls, thus preventing unwanted fluoride contamination of the tape by the instrument's operating environment. At preprogrammed time intervals the sampler shuts off the sample pump, indexes the tape and then samples a new section of tape. Approximately 600 samples can be collected on each tape set. The sample spots are cut out of the tape and subjected to one of the standard acceptable methods of fluoride analysis.

Analyte: Gaseous and particulate fluorides

Procedure: Bicarbonate tube

General Information:

Sample air is drawn through a glass tube which has sodium bicarbonate coated on the inner wall of the tube. The bicarbonate removes gaseous fluorides from the sample stream. A filter at the end of the tube captures the particulates from the sample. After the normal sampling interval (usually 24 hours), the sample flow is stopped. The filter is retained for analysis of particulate fluorides. The bicarbonate is washed out of the tube and analyzed for fluoride content. Recovery of gaseous HF is about 95% up until saturation of the tube at 500 ug F. Sample air which is high in acids (SO_2, NO_2, O_3 and hydrocarbons, at 50% or greater relative humidity) will react with the bicarbonate in the tube and reduce collection efficiency and total fluoride holding capacity. The lower detectable limit of the method is a function of the quality of the bicarbonate used for coating the tubes. Bicarbonate containing significant fluoride contamination will not have the low level resolution of fluoride free bicarbonate. The minimum detectable limit is determined as two standard deviations of the mean of the blank values. The blanks come from sample tubes which have been prepared for sampling but are maintained unexposed.

Analyte: Foliar Fluorides

Procedure: Colorimetric Method

General Information:

Forage samples are collected from pre-selected areas twice per month. Such areas must be growing hay or silage or being grazed by livestock when the samples are collected. Each sample consists of a composite of at least 25 clippings collected in a predetermined geometric pattern over the area. The entire aerial portion of the plant over 3 cm above the ground is collected.

The samples are collected and stored in Kraft bags under carefully regulated temperatures awaiting laboratory analysis. In the laboratory the samples are air dried at 80° C for 24-48 hours. The samples are then milled to pass a 40 mesh sieve. The milled samples are dissolved in solution, distilled, buffered and analyzed with a colorimeter or by the ion specific electrode.

APPENDIX Q

Air Quality Data Inputs

APPENDIX Q

AIR QUALITY DATA INPUT

Agencies and companies often need to input their air monitoring data to the state's computer system (AQDHS). This appendix is a brief summary of the various data forms and magnetic tape requirements for inputting data.

Figures AP-1-Q through AP-4-Q show four input forms used for hourly, daily, and monthly data. Forms 2179 and BAC are used for daily (24-hour) data while form BAQ is generally used for monthly data. The SAROAD form is used only for hourly data. Brief instructions for forms 2179 and SAROAD follow the figures. Some parameter codes are listed.

Agencies and companies may input their data on magnetic tapes. The data must be of the same format as the beforementioned input forms. Tape requirements are as follows:

Standard IBM label (if labeled)

Prefer Non-labeled (NL)

9-track tape

800, 1600, 6250 BPI's (specified)

80 characters

Any blocking size (specified)

EBCDIC

SAROAD on one file only

BAC, BAQ, 2179 one file only

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
AIR QUALITY BUREAU

Date Received: _____

Analyst: _____

Date Completed: _____

	2	7
1	2	3

HV Mem. Dichot.

Parameter					
23	24	25	26	27	

Parameter					
37	38	39	40	41	

Parameter					
51	52	53	54	55	

Parameter					
65	66	67	68	69	

Method	Units	DP			
28	29	30	31	32	

Method	Units	DP			
42	43	44	45	46	

Method	Units	DP			
56	57	58	59	60	

Method	Units	DP			
70	71	72	73	74	

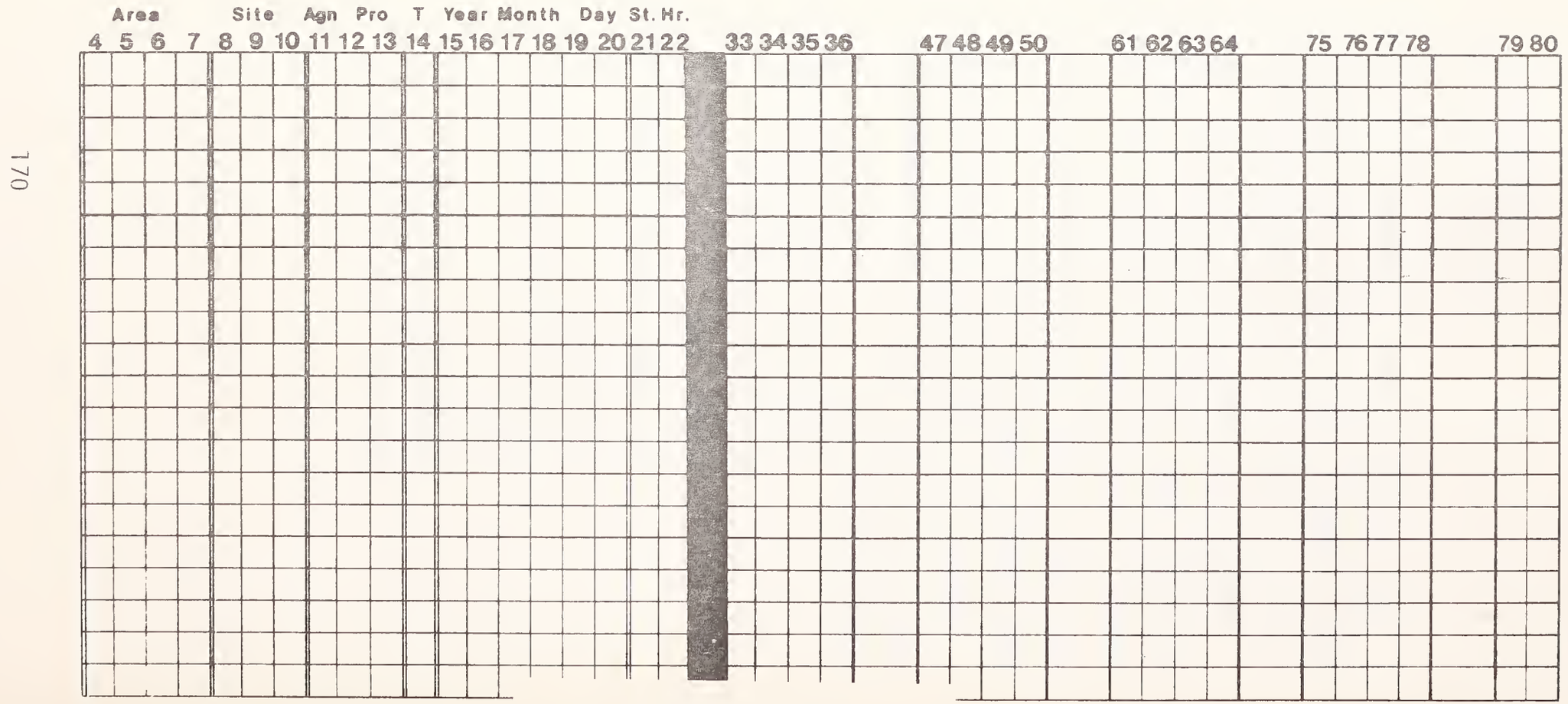


Figure AP-1-Q

Form: 2179 Comments:

DATA INPUT FORM - 2179

MONTANA STATE DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
Helena, Montana

State	Agency	Project	Time	Year	Period (month)	Number of Spls.	Comp Spl. Type	Time
2 3	11	12 13	14	15 16	17 18	19 20	21 22	

2

Area Address

Collected By

Date Received Date Reported

Analyst

Comments or unusual activities:

Name PARAMETER Code	Method	Units	DP
23 24 25 26 27	28 29 30 31 32	33 34 35 36	4 3 2 1 0
37 38 39 40 41	42 43 44 45 46	47 48 49 50	4 3 2 1 0
51 52 53 54 55	56 57 58 59 60	61 62 63 64	4 3 2 1 0
65 66 67 68 69	70 71 72 73 74	75 76 77 78	4 3 2 1 0

Lab. No.	Sample No.	Location and Description	Date Out	Date In	Sampling Period	Area 4 5 6 7	Site 8 9 10

STATE DEPARTMENT OF HEALTH

AND ENVIRONMENTAL SCIENCES

HELENA, MONTANA

24-HOUR OR GREATER SAMPLING INTERVAL

2

1 Agency

City Name

Site Address

Project

Time Interval

State Area Site

2 3 4 5 6 7 8 9 10

Agency Pro. T. Year Month

11 12 13 14 15 16 17 18

Day 19 20	Collection Lab. No.	Filter No.	Date Sample Logged	Operator	Total Volume Air (M3)	Unusual Circumstance *	Day 19 20	21 22
01							01	
02							02	
03							03	
04							04	
05							05	
06							06	
07							07	
08							08	
09							09	
10							10	
11							11	
12							12	
13							13	
14							14	
15							15	
16							16	
17							17	
18							18	
19							19	
20							20	
21							21	
22							22	
23							23	
24							24	
25							25	
26							26	
27							27	
28							28	
29							29	
30							30	
31							31	

172

TSP Name PARAMETER Code	Method	Units	DP
23 24 25 26 27	28 29 30 31 32	33 34 35 36	

Org Name PARAMETER Code	Method	Units	DP
37 38 39 40 41	42 43 44 45 46	47 48 49 50	

As Name PARAMETER Code	Method	Units	DP
51 52 53 54 55	56 57 58 59 60	61 62 63 64	

Pb Name PARAMETER Code	Method	Units	DP
65 66 67 68 69	70 71 72 73 74	75 76 77 78	

Cd Name PARAMETER Code	Method	Units	DP
23 24 25 26 27	28 29 30 31 32	33 34 35 36	

Zn Name PARAMETER Code	Method	Units	DP
37 38 39 40 41	42 43 44 45 46	47 48 49 50	

$SO_4^=$ Name PARAMETER Code	Method	Units	DP
51 52 53 54 55	56 57 58 59 60	61 62 63 64	

Name PARAMETER Code	Method	Units	DP
65 66 67 68 69	70 71 72 73 74	75 76 77 78	

Day 19 20	33 34 35 36	47 48 49 50	61 62 63 64	75 76 77 78
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
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22				
23				
24				
25				
26				
27				
28				
29				
30				
31				

DP → 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0 4 3 2 1 0

Comments or unusual circumstances

* codes 0 = excess of 24 hr. 5 = dry
1 = approx. 72°F 6 = clear
2 = approx. 32°F 7 = hazy
3 = rain 8 = calm
4 = snow 9 = windy

BAQ
3/72

Figure AP-3-Q

DATA INPUT FORM - BAQ

LESS THAN 24-HOUR SAMPLING INTERVAL

1 (1) Agency

AIR QUALITY BUREAU

State (2 3) Area (4 5 6 7) Site (8 9 10)

2 7

City Name

Site Address

Project

Parameter observed

Method

Time interval of obs.

Units of obs.

Agency (11) Project (12 13) Time (14) Year (15 16) Month (17 18)

Parameter code (23 24 25 26 27) Method (28 29) Units (30 31) DP (32)

Day (19 20)	St Hr (21 22)	Rdg 1 (33 34 35 36)	Rdg 2 (37 38 39 40)	Rdg 3 (41 42 43 44)	Rdg 4 (45 46 47 48)	Rdg 5 (49 50 51 52)	Rdg 6 (53 54 55 56)	Rdg 7 (57 58 59 60)	Rdg 8 (61 62 63 64)	Rdg 9 (65 66 67 68)	Rdg 10 (69 70 71 72)	Rdg 11 (73 74 75 76)	Rdg 12 (77 78 79 80)
01	00												
01	12												
02	00												
02	12												
03	00												
03	12												
04	00												
04	12												
05	00												
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13	00												
13	12												
14	00												
14	12												
15	00												
15	12												
16	00												

Figure AP-4-Q

DATA INPUT FORM - SAROAD

FORM 2179

Col 1	Will always be coded 2, which indicates a 24-hour sample
Col 4-10	Area and site codes (different for each site, supplied by AQB)
Col 11	Agency code = J (indicates company, other letters indicates agencies)
Col 12,13	Project code = 02 (or 07 if sampler is colocated)
Col 14	Time code = 8
Col 15 - 20	Year, Month, Day the sample was run (YY,MM,DD)
Col 21, 22	Start hour = 00 (for all TSP readings)
Col 23 - 27	Parameter code = 11101 for TSP
Col 28,29	Method code = 91 for TSP
Col 30,31	Unit code = 01 for TSP
Col 32	Decimal code = 0 or 1 depending on analysis - but be consistent
Col 33-36	data
Col 37-46	Additional parameters
Col 47-50	space for data for parameter in Col 37-46, and so on
Col 80	always coded 2 to indicate new data

If a sample is void, write comments to the left of Col 4 - never write comments in the numered areas reserved for data.

SAROAD FORMS

These forms are numbered according to the days of the month. They are completed similarly to 2179 with these exceptions:

Col 14	Time code - 1 for hourly data
Col 23-32	Parameter, method, unit, decimal depending on monitoring equipment. See Parameter Code Description Table
Col 33-80	Data (for negative numbers contact AQB for correct procedure)

PARAMETER CODE DESCRIPTION TABLE

Parameter	Code	Method	Units	Decimal	Method Description
TSP	11101	91	01	0 or 1	Gravimetric
Wind Speed	61101	50	11	1	Electronic Avg-meters/second
	61101	40	12	1	Visual Avg-miles per hour
Wind Direction	61102	50	14	0	Electronic Avg-degrees
	61102	40	14	0	Visual avg-degrees
Wind Deviation	61106	50	14	0	Electronic Avg-degrees
Wind Peak	61110	50	11	0	Electronic-meters/second
	61110	40	12	1	Hourly peak-miles per hour
Temperature	62101	50	17	1	Electronic Avg-^{o}Centigrade
	62101	40	15	1	Machine Avg- ^{o}Farenheit
Dew Point	62103	50	17	1	Electronic Avg-^{o}C
	62103	40	15	1	Visual Ave-^{o}F
Barometric Pr	64101	11	16	1	Aneroid - millibars
	64101	11	22	1	Aneroid - inches mercury

APPENDIX R

Acronyms and Abbreviations

APPENDIX R

ACRONYMS AND ABBREVIATIONS

AA	Atomic absorption spectrophotometry
ACFM	Actual cubic feet per minute
ADP	Automatic data processing
APCA	Air Pollution Control Association
APRAC	Urban diffusion model for CO
AQB	Air Quality Bureau
AQCR	Air quality control region
AQDHS	Air Quality Data Handling System
AQDM	Air Quality Display Model
AQMA	Air Quality Maintenance Area
ARM	Administrative Rules of Montana
As	Arsenic
ASTM	American Society for Testing Materials
BACT	Best Available Control Technology
B(a)P	Benzo-(a)-pyrene
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CALINE	California Line Model for CO
Cd	Cadmium
CDHS	Comprehensive Data Handling System
CDM	Climatological Dispersion Model
CEMS	Continuous Emission Monitoring System
CFR	Code of Federal Regulations
CO	Carbon monoxide
CO_2	Carbon dioxide
CRM	Certified Reference Material
CRSTER	Single Source meteorological model
Cu	Copper
DAS	Data aquisition system
DHES	Department of Health & Environmental Sciences
DHS	Data Handling System
DNRC	Department of Natural Resources and Conservation
DSCF	Dry standard cubic feet
DSL	Department of State Lands
EA	Environmental Assessment
EIC	Environmental Information Center
EIS	Environmental Impact statement
EIS/P&R	Emission Inventory System/Permits and Registration
EPA	United States Environmental Protection Agency
EQC	Environmental Quality Council
ESD	Environmental Sciences Division
ESP	Electrostatic Precipitator
ES&T	Environmental Science and Technology

F	Fluorine (fluoride)
FAA	Federal Aviation Administration
FBC	Fluidized bed combustion
FGD	Flue gas desulfurization
FID	Flame Ionization detector
FPD	Flame photometric detector
G or (g)	Grams
GC	Gas chromatography
GR or (gr)	Grains
HC	Hydrocarbons
HF	Hydrofluoric acid
HIWAY	Meteorological model for CO
HPLC	High performance liquid chromatography
H_2O	Oxide of hydrogen
H_2S	Hydrogen sulfide
H_2SO_4	Sulfuric Acid
ICP	Inductively Coupled Plasma
I/M	Inspection and maintenance
IP	Inhalable particulates
ISC	Industrial Source Complex model
JAPCA	Journal of Air Pollution Control Association
LAER	Lowest achieveable emission rate
M	Meter
M^3	Cubic meters
MAAQS	Montana Ambient Air Quality Standards Study
MAPS	Montana Air Pollution Study
MCA	Montana Codes Annotated
MCAA	Montana Clean Air Act
MEPA	Montana Environmental Policy Act
MHD	Magnetohydrodynamics
MS	Mass Spectrometry
MCCHD	Missoula City-County Health Department
MO	Montana Office (EPA)
Mu	Micron
NA	Neutron Activation or Nonattainment
NAAQS	National Ambient Air quality Standards
NADB	National Aerometric data Bank
NADP	National Atmospheric Deposition Program
NAMS	National Air Monitoring Station
NBS	National Bureau of Standards

NDIR	Nondispersive Infrared Analysis
NEDS	National Emission Data System
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for hazardous air pollutants
Ni	Nickel
NMHC	Non methane hydrocarbons
NMR	Nuclear magnetic resonance
NOAA	National Oceanic and Atmospheric Administration
NOx	Oxides of Nitrogens
NO_2	Nitrogen dioxide
NO_3	Nitrate
NPRC	Northern Plains Resource Council
NSPS	New source performance standards
NTIS	National Technical Information Service
NWS	National Weather Sevice
O	Oxygen atom
O_2	Oxygen molecule
O_3	Ozone
PAL	Point, area and line source air quality model
Pb	Lead
PBL	Planetary boundary layer
PER	Preliminary Environmental Review
PM	Preventive Maintenance
PNA	Polynuclear aromatic hydrocarbon
POM	Polycyclic organic matter
PPM	Parts per million
PSD	Prevention of Significant Deterioration
PSI	Pollutant standards index or pounds per square inch
PTDIS	Single stack meteorological model
PTMAX	Single stack meteorological model
PTMTP	Multistack meteorological model
P&A	Precision and accuracy
QA	Quality Assurance
RACT	Reasonably available control technology
RAM	Urban air model for point and area sources
RP	Respirable particulates
S	Sulfur
SAMWG	Standing Air Monitoring Work Group
SAROAD	Storage and retrieval of aerometric data
SI	International system of units
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Station
SO_2	Sulfur Dioxide
SO_4	Sulfate
SPM	Special purpose monitoring station
SPSS	Statistical Package for the Social Sciences
SRM	Standard reference materials
SWMB	Solid Waste Management Bureau

TCM	Texas Climatological Model
THC	Total hydrocarbons
TLV	Threshold limit value
TRS	Total reduced sulfur
TSP	Total Suspended Paritculate matter
UG/M^3 (or ug/m^3)	Micrograms per cubic meter
UNAMAP	User's Network for Applied Modeling of Air Pollution
USEPA	United States Environmental Protection Agency
V	Vanadium
VALLEY	Meteorological Model for concentrations on elevated terrain
WQB	Water Quality Bureau
XRF	X-ray fluorescence
YCAPC	Yellowstone County Air Pollution Control
Zn	Zinc

APPENDIX S

AQCR's and Area Codes

APPENDIX S

AQCR'S AND AREA CODES

As per the Clean Air Act, the Administrator for the EPA divided the State into geographic areas or air quality control regions (AQCR). These are as follows:

AQCR	Name
140	Billings
141	Great Falls
142	Helena
143	Miles City
144	Missoula

Figure AP-1-S shows the boundaries of Montana's five AQCR's on a map of the state.

Area codes for Montana are listed on Table AP-S-I.

AQCR's and area codes are used by data users for requesting or processing data.

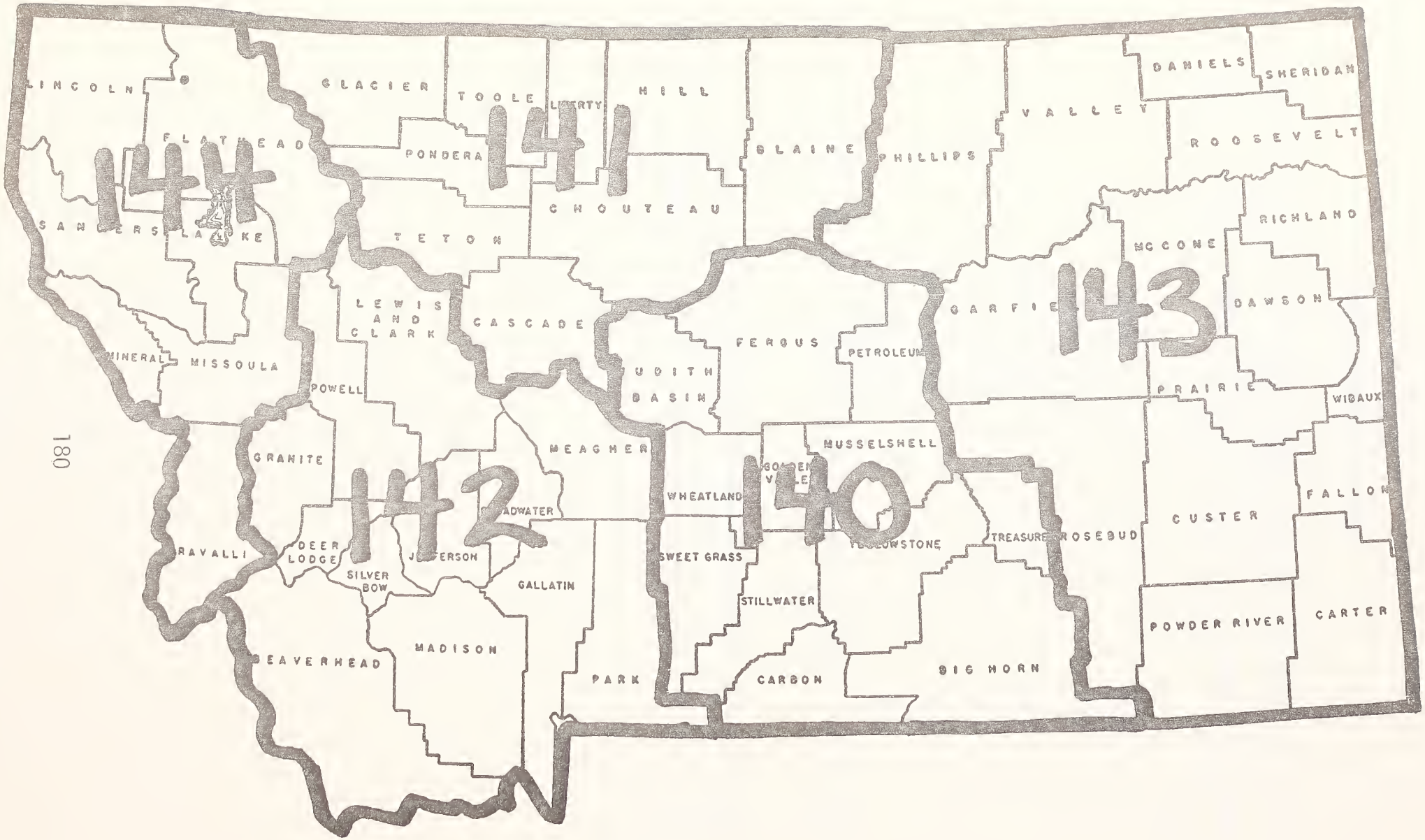

Figure AP-1-S

MONTANA AIR QUALITY CONTROL REGIONS

Table AP-S-I

MONTANA AREA CODES

0020 ANACONDA
0030 BAKER
0040 *BEAVERHEAD
0060 *BIG HORN
0080 BILLINGS

0100 *BLAINE
0120 BOZEMAN
0140 *BROADWATER
0160 BUTTE
0180 *CARBON

0200 *CARTER
0220 *CASCADE
0240 CENTERVILLE DUBLIN GULCH
0260 *CHOUTEAU
0270 COLUMBIA FALLS

0280 CONRAD
0300 *CUSTER
0320 CUT BANK
0340 *DANIELS
0360 *DAWSON

0380 DEER LODGE
0400 *DEER LODGE
0420 DILLON
0440 *FALLON
0460 *FERGUS

0480 *FLAT HEAD
0500 FLORAL PARK
0520 *GALLATIN
0540 *GARFIELD
0560 *GLACIER

0570 GLACIER NAT PARK
0580 GLASGOW
0600 GLENDIVE
0620 *GOLDEN VALLEY
0640 *GRANITE

0660 GREAT FALLS
0670 HAMILTON
0680 HARDIN
0700 HAVRE
0720 HELENA

0740 *HILL
0760 *JEFFERSON
0780 *JUDITH BASIN
0800 KALISPELL
0820 *LAKE

0840 LAUREL
0860 *LEWIS AND CLARK
0880 LEWISTOWN
0900 LIBBY
0920 *LIBERTY

0940 *LINCOLN
0960 LIVINGSTON
0980 *MC CONE
1000 *MADISON
1010 MALMSTROM

1020 *MEAGHER
1040 MILES CITY
1060 *MINERAL
1080 MISSOULA
1085 MISSOULA SOUTH

1090 MISSOULA WEST
1100 *MISSOULA
1140 *MUSSELSHELL
1160 *PARK
1180 *PETROLEUM

1200 *PHILLIPS
1220 *PONDERA
1240 *POWDER RIVER
1260 *POWELL
1280 *PRAIRIE

1300 *RAVALLI
1320 *RICHLAND
1340 *ROOSEVELT
1360 *ROSEBUD
1380 ROUNDUP

1400 *SANDERS
1420 SHELBY
1440 *SHERIDAN
1460 SIDNEY
1480 *SILVER BOW

1500 SILVER BOW PARK
1520 *STILLWATER
1540 *SWEET GRASS
1560 *TETON
1580 *TOOLE

1600 *TREASURE
1620 *VALLEY
1640 *WHEATLAND
1660 WHITEFISH
1680 *WIBAUX

1700 WOLF POINT
1720 *YELLOWSTONE
1740 YELLOWSTONE NAT PARK

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